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AMERICAN PEAT SOCIETY

A QUARTERLY JOURNAL DEVOTED TO THE DIFFUSION OF KNOWLEDGE OF THE UTILIZATED OF PEAT, AND THE DEVELOPMENT OF AMERICAN PEAT RESCOURCES

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CONTENTS AND INDEX

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(*The Names of Contributors are printed in Small Capitals.*)

Journal of the
American Peat Society

VOL. VI JANUARY, 1913 No. 1

Incorporation of the American Peat Society

At the Kalamazoo Meeting, September 1911, Messrs, J. N. Hoff and H. Philipp were appointed to incorporate the Society. Mr. Hoff, with his usual and characteristic benevolence, defrayed the necessary expenses. After careful and serious investigation it was decided to incorporate under the Laws of the State of New York, and for this purpose the necessary papers were drawn up by a competent lawyer towards the end of 1911. This certificate was circulated, by mail, among the elected officers of the Society to obtain their signatures before a notary public. As these officers live at various places and reside in various States of the Union, the Secretary of State of New York requested that the notary's signatures and seals be duly authenticated by the proper county or court officers in States outside of the State of New York.

The obtaining of these signatures had already entailed considerable time, so that it was decided to wait until the annual meeting, September 1912, in New York, when all the necessary parties could sign the Incorporation certificate without entailing any inconvenience of having notarys' signatures and seals countersigned by court officers; which would, however, not be met with any difficulty, but is a time consuming work and therefore to our industrious and hard working members somewhat undesirable.

The certificate was ready for signing at the annual meeting and was duly signed before a notary public by Messrs. Julius Bordollo, G. Herbert Condict, Ernest V. Moore, Eugene Haanel, John N. Hoff, Joseph A. Holmes, T. Arthur Mighill, Chas. F. McKenna, Herbert Philipp, J. Hyde Pratt and Chas. A. Davis.

The corporation is known as a membership corporation persuant to the provisions of Chapter 40 of the Laws of 1909, entitled "Membership Corporation Law," known as Chapter 35 of the Consolidated Laws and the acts amendatory thereof and supplemental thereto.

It is stated that the objects for which the corporation is to be formed are to investigate and experiment with all kinds of vegetable products known as peat, turf and bog deposits for any purpose whatsoever. To study and devise means of preparing such products for use, to gather and disseminate information concerning all such matters, by publication, correspondence, conventions, lectures or otherwise, and by conducting experimental plants for educating the public as to the value of these products, to encourage in every way the utilization of peat, turf, and bog deposits.

This certificate was approved by Justice Samuel Greenbaum of the Supreme Court of the State of New York on November 21st, 1912 and filed and recorded in the office of the Secretary of State of New York on November 29th, 1912. H. P.

EFFECT OF MOISTURE IN PEAT.

In an extra published in **Engineer** the statement is made, that the difference between the results obtained from peat with 34 per cent. water and 62 per cent. water are almost negligible, while the gas is as good as that from the best Welsh anthracite. In fact, peat is an almost ideal fuel for use in a producer, for it does not clinker, leaves but little ash, and the grate is kept clean. A centrifugal extractor deals with the tarry matter satisfactorily. Critics of the theory of drying peat **in situ** may ask, with a show of reason, what is to prevent the winter's rain undoing all the work of the summer's sun, even though the mass be drained in the manner proposed, in which event the peat harvest would be confined, as at presnet, to the short summer months; but the Dutch have proved that a stack of peat will emerge from winter with only 40 per cent., or thereabout, of water.—(From **Steam,** Vol. 10, p. 180, 1912.) H. P.

IMPROVEMENTS IN THE PRODUCTION AND UTILIZATION OF PEAT.*

By Dr. W. Wielandt, Oldenburg, Ger.

Since the cost of coal has risen considerably in all countries, inferior fuels such as lignite, peat, etc., have been given more serious attention, especially as these inferior fuels are most abundant in countries where the coal supply is scarce.

A large peat industry however, has not been able to be developed yet, because on the one hand it was self-evident that hand labor was out of the question, and on the other hand peat machines known up to this period required a large number of skilled laborers, so that peat production became more expensive than by manual labor alone.

The last years have shown decided improvements, namely in the peat machines of Dr. W. Wielandt, who for years has exclusively been interested in peat deposits, and who in 1905 founded the peat plant at Elisabethfehn in the province of Oldenburg, which has now developed into the largest peat plant in that province.

The new peat dredger with attached spreader, in contrast to the other existing machines, is entirely automatic, as all operations, namely the dredging, mixing and molding as well as cutting in blocks, spreading on the drying field and moving the machine, are carried out automatically, so that the attention to the motors and laying of the rails only require two or three workmen, according to the condition of the bog.

The dredger consists of one track, of 600 m. m. (25.6 in.) gauge, upon which it moves at the rate of 20-30 meters (65 ft. -98 ft.) per hour, on the side is attached a bucket elevator 0.8-1.2 meters (2.6 ft.-3.9 ft.) wide and 2-5 meters (6 ft.-15 ft.) deep, a macerator into which the buckets empty the peat by means of a hopper, a mould of pentagonal section, a cutter which automatically cuts the moulded peat into blocks of equal length and an unloading device behind the dredger which excavates a trench in which it unloads the peat blocks, attached to the machine is the spreader which consists of plates on an endless belt, the plates take the blocks as soon as they leave the moulds and places them in the drying field (about 15-30 meters (45 ft.-90 ft.) wide) in horizontal position. The power is produced either by electric or benzene motor. The dredges are built to excavate 60-70 cubic meters (78-91 cu. yds.) per hour, corresponding to 5-10 tons of air dried peat and weigh complete with spreader, according to their size, 3,000 to 5,000 kilos (6,600-11,000 lbs). The machine requires 20-32 horsepower.

*Extracted from the Transactions of the Eighth International Congress of Applied Chemistry. H. P.

The newest machines excavate a breadth of one meter and form a drying field of an average breadth of 20 meters (65 feet) while previously 3-4 meters (10 feet-13 feet) width was excavated and a width of 80-100 meters (262 feet-328 feet) was used as a drying field. By this method only the dried trench walls are excavated, which contain about twice as much dry substance per cubic meter as the other layers of the deposit, thus making the molded material much drier than by the old method. By this means the drying is accomplished in from 4-10 days before stacking and the peat can be taken from the field within from 2-4 weeks and stored. In conclusion, from this, the drying field can be used several times during the summer and allows the peat to be excavated until autumn. Thereby is achieved a quick drying of the peat without artificial heat or mechanical or expensive pressing. Further the cost for drying and collecting is much lower than previously, because the peat is not spread out over such a wide area and the transportation tracks are closer together. The peat is now excavated so as to give a slope to the side walls of the trench, offering less chance of caving in and better opportunity of excavating poorly drained deposits.

Further advantages of this new system are as follows:

1st. All motions are continous and regular, which gives a simple construction and easily operated machine. Power consumption is even and wear and tear is at a minimum.

2nd. The excavator can be raised or lowered and set at any angle without shutting down the machine, so that the interruptions through the presence of tree stumps can be overcome without loss of time.

3rd. In changing the position of the machine, the excavator is raised to a horizontal position, allowing the machine to be turned in any direction without taking anything apart. The transportation of the machine is easy, even for great distances, as it has normal guage.

4th. The buckets take from all layers of the deposits, from which results a more uniform and denser product than by manual labor.

5th. On account of the small amount of labor required, the machine can be operated day and night.

6th. The excavator can also be used in deposits where a large number of tree stumps occur, as the excavator is narrow and the trench is easily accessibly allowing the roots to be removed by hand without any difficulty, before the excavator reaches them.

The excavating cost with this machine varies from 4-5 Marks (92c-$1.15) per 10,000 Kilograms (22,000 lbs.) air dried

peat including power, 7 Marks ($1.61) for drying, 4 Marks (92c) for supplies, repairs and labor, 4-5 Marks (92c to $1.15) for transportation and 4-5 Marks (92c-$1.15) for deterioration, etc. A total of about 25 Marks ($5.75) per 10,000 Kilos (22,000 lbs.)

At the Elisabethfehn plant there are four different machines in operation which were in use until the 16th of Sept. Further the same deposit was gone over every 2-3 weeks, thus the same parts were gone over 8-10 times in a summer, while previously this only happened once during a season. The product from this deposit was uniform and hard, which is due to the faultless mechanical handling of the material.

The use to which large amounts of peat should be put is an open question. Since 1907 a peat coking plant, system Dr. Wielandt, at Elisabethfehn, has shown itself to be extremely profitable and without doubt the best means of using peat.

This plant consists of 3 coking ovens, with a capacity of producing 9 tons coke in 24 hours from 30 tons of peat, the necessary electric power for operating the peat plant and coke storage, a peat tar distillation for producing creosote oils, gas oils, paraffine and pitch and raw liquor still for producing acetate of lime and ammonium sulphate. The principle of the numerous patents on this coke oven consists of placing the proper number of connecting pipes between the upper part of the oven and the lower part of the cooling chamber and at the same time placing the gas outlet pipes between the drying and gassing zones.

The peat coke is especially used for copper smelting, charcoal iron, being preferred for the same because it is denser, harder and more yielding. Sulphur contents = 0.15 per cent, ash contents = 3-5 per cent and the heating value = 7,000 Cal. per Kg. (1750 B. T. U. per lb.)

Of the by-products, the gas oil is used for carburetting water gas and making oil gas, also when purified for the Diesel motor. The pitch is used for coal briquettes and weather proof paper. The cost of the production of peat coke is in a 12,000 ton per anum plant, including deterioration etc., 18-20 Marks ($4.14-$4.60). With a 3,000 ton plant less than 10 Marks ($1.30) per ton. Therefore, from a large plant the coke can be sold for heating material to which it is well adapted because it is smokeless and oderless.

Installation costs for a 12,000 ton plant is 700,000 Marks, ($161,000) for a 50,000 ton plant about 1,500,000 Marks ($345,-000.).

There is no doubt that the above described process for peat utilization is of enormous importance to America as an efficient method of utilizing the energy nature has stored up in the peat deposits.—(Translated by H. P.)

THE UTILIZATION OF PEAT FUEL.*

By H. Poynter Bell.

The report on the utilization of Peat fuel for the production of power, issued by the Dominion Department of Mines, was mentioned in the columns of **The Canadian Engineer** some weeks ago; it is, however, of such importance that it calls for further mention than could then be given to it. The report is so written as to be useful to power users in general, as well as to engineers, and contains an account of the actions and processes which take place in the producer, and of the construction and manner of operation of the gas engine. A full description is given of the plant and testing apparatus at the fuel testing station at Ottawa, and of changes in the gas-producer and gas-cleaning plants, made during the series of tests in order to obtain better results.

The nature and the results of the tests which were made are simply described for the use of non-technical readers, but, besides this, details of all observations are given in full for the information of engineers and those who have special knowledge of the subject. The very encouraging results which were obtained may be commended particularly to the notice of those whose ideas on the utilization of peat are founded on the failure of some previous attempts in the same direction. Many such attempts were made at a time when the nature and proper methods of using peat were very imperfectly understood in both America and Europe. They were made with unsuitable appliances and often without regard to the differences between Canadian and European peat. Since that time very great improvements have been made in Europe in the methods of treating and using peat, while knowledge about Canadian peat has been considerably advanced, chiefly through the work of the Department of Mines.

The present report shows clearly that with suitable conditions power can be obtained from peat by the use of gas-producers and gas-engines, at a cost which compares favorably with that of power from coal, and may even, in some cases, be at least as low as the cost of hydro-electric power. It is not pretended that this can be the case in all places and for all purposes, but if the power can be raised at or near the peat bog, and more especially if it is required for a fairly uniform load, peat producer gas is clearly a very economical fuel.

It is found that peat in a suitable condition for use in the gas-producer can now be delivered f. o. b. at the bog—that is,

(*Reprinted from The Canadian Engineer, 1912, Vol. 23, p. 765.)

at the producer if it is on the spot—for not more than $2 per ton, which is equivalent to $4 or even less per ton for high-grade coal. On this basis electric power can be produced, as shown in the report, at a fuel cost of $8.40 per horse-power per year of 3,000 hours. The whole of the work required on the plant used at Ottawa (60 horse-power) could be done by one man.

The tests were evidently made under fair working conditions, and with the use of only such plant and appliances as are obtainable by everyone. A producer and engine were chosen of a type which had proved successful with European peat. As a result of the experience gained in the earlier tests, changes were made in the producer which, as completely described in the report, may be taken as a type suitable for use with Canadian peat.

The results given, satisfactory as they are, need not be considered to be the best that can possibly be obtained. Apart from improvements which may be made in the getting of the peat, there are various other gas-producers and engines designed for use with peat and it is possible that with some one or more of them even better efficiency may be obtained than that which is shown in the report.

The report gives, further, a description of some heaters intended for utilizing the exhaust heat of gas engines. Tests with these heaters had not been made when the report was written, but particulars are given of tests made elsewhere with heaters of this kind. It appears from these tests that not less than 40 to 50 lbs. (4 to 5 gallons) of water can be heated by the engine jacket and the heater to 190 deg. Fahr. per brake horse-power of the engine, and that the power of the heat so obtained are together equal to from 74 to 80 per cent. of the heat value of the gas supplied to the engine—a very remarkable economy.

In the estimate of cost here given no account has been taken of the savings to be made through the recovery of by-products, and particularly sulphate of ammonia—from the producer-gas. There exists already a demand for sulphate of ammonia in Canada, and its manufacture is very profitable if it is made in large enough quantities, that is to say, if large enough quantities of producer gas are made. The plant originally used for the recovery was rather large and expensive, but it has been found that the process can be greatly simplified and cheapened.

As stated above, the use of peat is economical when the conditions are suitable. One of the most important of these conditions is, of course, the nature of the peat which is to be

worked. To start work on a peat bog which has not been properly investigated is mere gambling. The work of investigating Canadian peat bogs is making steady progress under the Department of Mines; a number of good results have been obtained and there can be no doubt that many of the numerous bogs in central and eastern Canada will be found to give peat well suited for making fuel.

TO MAKE PAPER FROM PEAT.

W. Hellwig and F. Hermann, German paper manufacturers, have invented and patented (in Great Britain) an improved process for making pulp and paper from peat.

The process consists principally in allowing the material to be treated to remain some considerable time in a warm solution of chloride of lime, dilate hydro-chloric acid and potash or soda. When the solution has acted upon the material to a sufficient degree, which may be ascertained by taking samples and testing same, the material is removed from the solution and boiled with lime water.

The following is one example of carrying out the improved process:—10 kilo-grammes of 90 per cent. calcined soda (carbonate of soda that has been partially dehydrated by roasting) are dissolved in 100 litres of boiling water. The solution is then boiled for a time, being stirred at intervals. Then 2 kilograms of chloride of lime made into a paste with water are added to the boiling mixture. To this mixture, when cool, there are slowly added 3 kilograms of hydrochloric acid of about 20 degrees Be. The resulting liquor is then ready for opening the fibrous materials to be treated which are placed in the said liquor and allowed to remain therein for about 24 hours. The liquor is preferably warmed. At the end of this period the fibrous materials are removed and introduced into a vessel of boiling water, to which about five per cent. of burned lime has been added. The fibrous materials are boiled in this thin lime water for about two hours, after which the fibrous materials are washed in clear cold water for the purpose of removing as far as possible any free chemicals. The resulting mass is then suitable for further treatment for the manufacture of paper.—(From Pulp and Paper Magazine of Canada. Vol. 10, p. 381, 1912.) H. P.

THE VALUE OF PEAT AS A FILLER AND A FERTILIZER.*

By John M. McCandless, Atlanta, Ga.

Paper presented at the Annual Meeting of the Georgia Fertilizer Mixers' Association, held at Macon, Ga., Oct. 22, 1912.

No man can appreciate so well as the fertilizer manufacturer the great value of nitrogen. There are millions of tons of it in the atmosphere all around us, but of no value to the fertilizer manufacturer, because it is free and uncombined. Like the shipwrecked sailor adrift on the sea, who cries "Water, water everywhere, but not a drop to drink," so the fertilizer cries, "Nitrogen, nitrogen everywhere, but not a pound for use." Nitrogen must be combined either in organic or inorganic forms before it can be used by the fertilizer manufacturer. It must be in the form of protein as found in the organic ammoniates such as blood, tankage, and cotton seed meal, or in the inorganic form such as nitrate of soda or sulphate of ammonia, before it becomes useful.

With all of the recognized and useful ammoniates bringing enormous prices as compared with phosphoric acid and potash, no legitimate source of combined nitrogen should be overlooked. There are certain sources of nitrogen from which we have, to a certain extent been barred in the past by ignorance and inherited prejudices. One of these sources is leather and very properly should the use of raw leather be prohibited; but when the chemist and the manufacturer exert their skill and use their capital in the effort to convert raw leather into a new product yielding its nitrogen to the plant, then blind ignorance and prejudice and designing demagoguery should be made to take a back seat and not permitted to pass laws restricting its use.

Two years ago the writer made a plea for the recognition of this material before the Association of Commissioners of Agriculture, and showed that not only by chemical and bacteriological but also by crop tests that some of these leather products were equal in every respect to the standard ammoniates.

There is, however, another product against which a great deal of prejudice still exists. Recently a bill was introduced in our State Legislature to prohibit its use altogether. I refer to the material known as peat. Our laboratory has been making a study of this material for the past year or two and if I can say anything today which may in a measure tend to remove the prejudice existing against peat as a filler and a fertilizer and

*Reprinted from The American Fertilizer, Nov. 30, 1912.

present it to the favorable consideration and attention of the fertilizer trade, our laboratory will feel fully repaid for its labors, and will also feel that it is entitled to some of that recognition so generally bestowed upon the man who makes two blades of grass to grow where one grew before. In like manner, if we can aid in rescuing for the use of agriculture some of the buried treasures of nitrogen now lying unused and neglected in the bogs of Georgia and Florida, we shall feel that we have done something for the service of our fellow men.

Peat is formed in boggy places or swamps where water plants, mosses, rushes, sedges, etc., grow and then die down in the places where they have grown year after year, so that in time great masses of vegetable matter more or less decomposed gradually accumulate to form deposits of peat or muck. Peat and muck deposits have been utilized by farmers from time immemorial as a fertilizer material, being highly esteemed, especially after composting with other fertilizer materials.

In more recent years this material has come largely into notice of the fertilizer trade, since the better grades of peat showing from 2 to 3 per cent. ammonia have been prepared for market by various processes, resulting in a dry and finely divided product. The material thus offered to the trade on account of its percentage of ammonia and its extraordinary capacity for the absorption of water is highly esteemed by manufacturers as a filler, since, owing to its water absorbing capacity, it rapidly dries out damp materials with which it may be mixed so that they can be more easily handled.

As a filler it is seldom ever used in quantity greater than 300 pounds per ton, so that a peat containing 2½ per cent. of ammonia would furnish to goods guaranteed 2 per cent. ammonia, only 0.35 per cent. of its total ammonia. Now the use of peat in commercial fertilizer has been objected to on this ground, that a portion of the nitrogen of the fertilizer is derived from the peat, and the claim is made that this nitrogen is insoluble and unavailable and that therefore the use of the peat as a partial source of nitrogen should be prohibited.

The writer when state chemist of Georgia some years ago objected to the use of peat in commercial fertilizers on these grounds, and because some agricultural authorities had stated that the nitrogen of peat was practically worthless. Therefore it was required of the parties manufacturing the peat to which exceptions were taken that they demonstrate the agricultural value of their product by crop tests undertaken under proper scientific direction. These crop tests were carried out under such disinterested and scientific supervision with flattering results to the value and availability of the nitrogen in the peat.

After submission of these results the prohibition against the use of this particular peat was removed.

The object of this paper is to examine the objections urged against the use of peat by some of those exercising scientific control, and to ascertain if they are altogether well founded. There will be no attempt to dispute the proposition that raw sour acid peat just as it is dug from the bog contains nitrogen in a form which is insoluble in water and comparatively inert considered as a source of plant food. It is unquestionably this statement made by some agricultural experts which causes the hostile attitude assumed towards peat by some of these exercising scientific control.

But the proposition that peat which has been prepared for market by special methods and by drying, grinding and neutralization of its acid nature is still open to such criticism cannot be granted. In the first place, it should be stated that there are peats and peats; in some the nitrogen is much more soluble and available than in others, and each brand of peat should be required to stand on its own merits. I propose to fortify my position in defense of peat by citations from distinguished writers and authorities on agriculture. Storer, a recognized authority on agriculture, says, "For some kinds of peat, at least, it is true that ammonia may be formed from their nitrogen compounds continually, when the peat is kept in a warm place and exposed to air and moisture. In many cases this formation probably depends on the action of micro-organisms, as in the experiments of Selmi and others; but in other instances the ammonia appears to be derived from a splitting of the nitrogen compounds, that is from the breaking up of amids, as was doubtless the case in certain experiments of Storer where the conditions as regards temperature excluded all living things."

Also Brunemann on drying moor earth or peat earth at tolerably high temperatures found that part of the inert nitrogen compounds in the peat became soluble in water.

Tacke also found that on heating moor earth in water as much as 1 per cent. of it became soluble at 104 degrees F., 6 per cent. became soluble between 194 and 212 degrees F. Under a pressure of 1½ atmospheres 10 per cent. dissolved and under three atmospheres 16 per cent.

Again Prof. Cameron, the accomplished soil expert of the Bureau of Soils of the U. S. Department of Agriculture, says, "There is not so far as we are aware any scientific reason why in general such materials (peats or mucks) might not be found useful as fillers for mixed fertilizers. Particular mucks or peats on account of sourness or the presence of specific substances might be objectionable, but generally a thorough preliminary drying proves to be a satisfactory correction."

Storer also states that when peat even without previous preparation is exposed to the action of air as when mixed with any ordinary cultivated soil, its nitrogen slowly undergoes change and some of it becomes available for the plant in the same way that the nitrogen of bone meal would become under similar conditions. Nessler has shown that although the nitrogenous constituents of peat decompose in the soil more slowly than the ossein of steamed bone they do decompose more quickly than the ossein of coarse raw bone. Yet who would think of objecting to the presence of raw bone in a fertilizer? Raw bone is especially difficult to pulverize, and consequently much of the raw bone which goes into fertilizer mixtures is comparatively coarse in the size of its particles. It must be borne in mind that Nessler in making his statement as to the comparative availability of peat and raw bone did not have reference to peat which had undergone a special previous preparation for the market. When then the peat has been prepared under special processes, as claimed by the manufacturers, when we know that it has been at least dried at high temperatures, thoroughly exposed to the action of the air and ground to powder, it is fair to presume from the statements of the authorities already quoted that the availability of its nitrogen has been greatly increased, and that it is at least equal in availability if not superior to the average coarsely ground raw bone.

Furthermore, under the conditions in which peat is used in commercial fertilizer that is mixed with acid phosphate, blood, tankage, cottonseed meal and potash salts, the conditions are approximated which are admitted to be ideal for the decomposition of raw peat into humus. When such a mixture is put into the ground, under the influence of moisture, warmth and the action of the soil organisms the reaction between the decomposing constituents of the other fertilizers and the peat tend to slowly break down the latter and convert it into active and soluble humus, thus holding in reserve throughout the growing season a portion of the nitrogen in a gradually assimilable form. Thus Hess mixed samples of moor or peat earth with kainit, with sulphate of potash, with muriate of potash, and also with gypsum. He kept the moist mixtures in glass bottles for over a year and then leached them with water; from the bottles which contained the potash salts water dissolved out about eight times as much nitrogen as could be obtained from the peat which contained no potash salt, and also considerable quantities were obtained from the mixtures containing gypsum alone.

In fertilizer mixtures containing peat as a filler we always have potash salts as kainit or muriate and sulphate of potash, also gypsum and phosphates together with some other ammoniate readily yielding its ammonia in the soil. Hall in his work

on the soil says, "The various oxidation processes in the soil are like all other bacterial actions promoted by warmth, sufficient moisture, and the presence of mineral food, like phosphates and potash salts." Storer, the accomplished professor of agriculture in Harvard University, has much to say of the value of peat as a source of nitrogen when made into composts and gives directions for making such composts from many different materials. He says it is a strong point to be urged in favor of phosphatic composts that phosphate of lime promotes putrefaction by serving as food for the organisms which cause decay. Again, after mentioning some experiments by Dr. Johnson, he says, "If it be true as seems to clearly be the case that peat has the power to absorb and hold even as much as one-half of 1 per cent. of its weight of nitrogen when composted this fact is one of great importance."

It certainly is a fact of great importance; especially when we consider the rapidity with which blood and some other ammoniates putrefy in the soil and lose their ammonia, it would seem to be the part of wisdom to add to every fertilizer a small proportion of peat to act as an absorber and conserver of the ammonia and the amids liberated from the blood and the other readily decomposed ingredients. In this connection it is appropriate to quote from Davis (U. S. Geological Survey Bulletin 376) he says, "This filler should not be regarded as a harmful adulterant but rather as a dilutant or in some cases perhaps a necessary constituent of the mixture as it improves the whole both mechanically and chemically. It also permits the use of many kinds of waste animal matter rich in valuable nitrogenous compounds, which could not be used otherwise, because they absorb water from the air and give off offensive odors and soon decay, their nitrogen content being dissipated as gases, especially as ammonia. It is plain that peat adds to a fertilizer analysis a certain amount of nitrogen which is said not to be immediately available for plants, and as nitrogen is the most costly constituent of all fertilizers most agricultural chemists (exercising official control) object to this feature. Recent experiments, however, seem to show that at least one-third of the nitrogen in peat is immediately available for plants."

These recent experiments referred to by Davis are in line with and corroborate the special analyses of peat made by the McCandless Laboratory upon some samples intended for use as fertilizer fillers. These analyses were directed to the determination of the soluble humus in the sample, and the nitrogen contained in the humus, which may be considered to be in a form readily available as plant food. One of these analyses is given below.

Analysis of Peat Used as a Filler.

	Per cent.
Moisture	11.00
Active and soluble humus	24.36
Potential humus	56.05
Ash or mineral matter	8.59
	100.00
Nitrogen equivalent to ammonia in the actual humus	1.02
Nitrogen equivalent to ammonia in the potential humus	1.45
Total nitrogen, equivalent to ammonia	2.47

The above analysis differs in its nature from any other analyses ever made of peat previously for agricultural use, and may be considered to fairly measure the availability and agricultural value of the peat. All the analyses we have been able to find recorded in the literature simply give the fuel value of the peat and its nitrogen content, without any attempt to show the percentage of soluble humus and the humic nitrogen contained in it. This analysis shows the above peat to contain a very high percentage of soluble humus, which is the active principle in vegetable mold, and is the chief cause of the black color of soils rich in vegetable matter. By the term "Potential Humus" is meant the undecomposed vegetable matter of the peat, but in which resides the power of becoming slowly decomposed into actual and soluble humus.

This decomposition may be expected to gradually continue in cultivated soils until the whole of the potential humus has been converted into soluble humus. The nitrogen contained in the actual soluble humus in this particular peat is found on calculation to be 41.38 per cent. of the total nitrogen in the peat and is therefore in a condition to be readily absorbed and appropriated as plant food. This result obtained by analysis confirms the statement of Davis of the U. S. Geological Survey, that experiment has shown at least one-third of the nitrogen of peat to be immediately available for plants. The remainder of the nitrogen in the potential humus being as it is composted in the soil with phosphates, potash salts, gypsum, blood, cottonseed meal and other materials must gradually become available as plant food, as under the action of warmth, moisture and the activities of the soil organisms, the potential humus becomes converted into soluble humus.

MORE ABOUT HUMUS.

Robert Ranson, St. Augustine, Florida, U. S. A.

Nothing in connection with peat has such an attraction for me as the continued study of the possibilities of humus as applied to soils and as generally affecting agriculture.

On reading the very well written and I may say exhaustive articles published in all magazines relating to peat, it would seem as if nothing remained to be said on this most interesting subject, and my only excuse for again considering the matter is that I have lived the greater part of my life in Florida, a State for the most part consisting of such poor sandy soil so needful of fertilizing elements, and at the same time endowed by an all-wise Creator with vast beds of well decayed vegetable matter humus as to make it a veritable garden when properly applied to the aforesaid sandy soils.

Just a word as to the peats for the most part found in Florida. As far as I am able to discover we have peat of far older formation in this State than in any part of the world where peat has been at all studied. This was remarked to me by Mr. C. Lindley Wood, of Glasgow, Scotland, who during the past summer spent nearly two months with me making various tests. He had closely observed different peats in Ireland, Scotland, Italy, Germany and elsewhere and his conclusion was that our peat seemed much older than any he had so far seen on account of its almost entire absence of fiber or vegetable matter, either noticeable by the naked eye or by a powerful microscope. An amateur in peat some years ago, on looking at some fuel samples I had made, remarked, "Well, that is coal ten thousand years young." In addition to its appearance I might quote as to its probable age the fact that I have dredged up cypress trees ten feet in diameter at a depth of fifteen feet as soft as sponge. When we think of such a slow growing tree as the cypress attaining the diameter of ten feet, we are face to face with a fact that this tree must have been as old as the giant trees of California of the same relative size, and from a thousand to twelve hundred years must have passed since it sprouted from the ground; then when we consider its great durability, especially under water, we may safely figure a period of not less than two thousand years to reduce it to the state of decay in which I found it. The doors of St. Peter's Church at Rome which were built of cypress, in the time of Constantine, showed no signs of decay when after a lapse of 1100 years Pope Eugenius IV took them down and replaced them with doors of bronze. Many Egyptian coffins of much greater age are found

in excellent preservation ,to-day also made of this most durable wood, thus as in that excellent paper of Mr. Gladding, read at Kalamazoo, we are brought by these studies close to the fossil age.

I have thus arrived at the point which I desire to make in favor of the use of Florida peat or humus as a soil conditioner. We have something so decayed, as to form a most desirable plant food, when applied to the sandy soils we desire to enrich.

Speaking of different methods of adding nitrogen to our soils, a vital necessity to their continued production, Dr. Jodidi writes in his treatise entitled Organic Nitrogenous Compounds in Peat Soils, as follows:

"That though by various agencies of nature small amounts of nitrogen are yearly added to the soil, it is certain that to-day a much larger amount of nitrogen is removed from the soil by crops than is returned to it by synthetic or other means."

Thus the constant loss of nitrogen (in farming districts) must naturally be supplied by manures and expensive commercial fertilizers if the fertility of the soil is to be maintained. In the peat bogs, nature has placed at the command of men, soils with large quantities of combined nitrogen. Taking two and a half per cent. of nitrogen commonly contained in Florida peat we should have in each acre a foot deep, four tons of nitrogen, equivalent to twenty-four tons of nitrate of soda. Such a quantity of nitrogen if properly used would be sufficient for cropping for seventy-five years.

As all my readers know, peat as an enricher of soils has been constantly attacked by chemists on the ground that though it contains large amounts of nitrogen in a form unavailable for plant food and to prove this they refer to laboratory processes, which of course show a vast difference in the solubility of peat nitrogen and that contained in various nitrates, but fail to convince me that nature may not have countless methods of rendering peat nitrogen both soluble and available for plants of which the chemists have not yet thought, even in their dreams.

I am vastly encouraged in my belief that peat nitrogen is available for plant food when I see the great help it is to the growth of farm products, and I have yet to hear of any case where it has been liberally applied to sandy soils where marvelous results have not followed shortly after and the good of its application has been felt for years after. I am still farther pleased to read from the report of two eminent French chemists, published in the Canadian Mines Report. These chemists remark that these studies were not undertaken (intensifying nitrification by means of peat beds) with the object of applying the principle to agriculture; for it is not very important that

available or soluble nitrates be given direct to the land, since the soil to which nitrogenous matter is added, itself undertakes their transformation into nitrogen (nitrates). Our main object has been the production of nitrates necessary for the manufacture of explosives. We have before us two great reasons for adding humus to our thin sandy soils and though these have been pointed out by men far more competent than I am, I take the liberty of putting before you with emphasis the advantages to be derived from such additions to improve the physical nature of the soil: (a) By lightening it; (b) Increasing the absorption of the sun's heat; (c) To increase its capacity for holding water; (d) The slower loss by evaporation.

Quoting Mr. Gladding again, he says these four advantages are obtained by the admixture of peat soil or humus to the soils and are physical or mechanical in their nature.

They are wholly apart from any fertilizing value that may be contained in the peat and I have no hesitation in saying that the agricultural value of a peat soil which comes from these four physical properties is far greater than the agricultural value derived from the mere fertilizing elements present in such soil.

When, however, we reflect that both air dried and kiln dried peat can be purchased at the present time for the market value of the mere fertilizer ingredients therein contained and that all the above mentioned benefits which are of far greater value than the mere fertilizing ingredients, are obtained free of cost, we see the importance of impressing upon all farmers the necessity of using such a valuable material, especially for admixture with clay or sandy soil. I might quote from nearly every State agricultural chemist in this country who for the past few years have paid special attention to the value of humus, to show that when well decayed muck or peat can be easily obtained it is the cheapest form of nitrogen.

In these days of wireless communication and aerial navigation, shall the agriculturist lag behind in the march of improvements or for a moment be satisfied with methods that satisfied his ancestors? Our State Agricultural colleges are training up a new race of bread winners and teaching them to both wisely stimulate and at the same time conserve their soils, applying all of the exact sciences to assist them in their battle to wrest a living and something more from a somewhat stubborn and sin cursed earth.

It thus behooves all progressive farmers and students, who will shortly be farmers, truckers and orchardists to give close study to the advantages offered us by Dame Nature in the vast muck deposits of the State of Florida. My experience of the past ten years in working in peat shows me that most of the

vast stores of Humus are submerged and that this most valuable material must be excavated by dredges from varying depths from 3 to 15 feet.

We are thus face to face with a problem calling for a greater expenditure than possible by each farmer for himself. My suggestion to overcome the trouble is a co-operative association with an investment sufficient to properly excavate and dry humus for the needs of each member and have some left over to dispose of. The vast beds of humus, now being for the first time exposed by the drainage operations in various parts of the State, have in my humble opinion a far greater value as humus to mix with our sandy, rocky or clayey soils than as soil in themselves on which to grow crops. In closing this article I trust I may have impressed on some of our readers the advantages they may gain from a closer study of the subject of humus and interest in the American Peat Society.

HISTORICAL NOTE ABOUT PEAT BATHS.

(Extracted from Oest. Moorzt., 1912, Vol. 13, p. 100.)

The Dr. F. Boschan claims that although the real use of peat baths for curative purposes was first put to advantageous use in the last century by the German balneological doctors, yet the actual original idea of using peat baths belongs to ancient history.

Pliny the younger occasionally refers to such mud baths in his writings, and his knowledge of the existence of peat deposits in northern Germany has been acceded. There are references by the Romans to show that the slimy water from these deposits were used for curative and cosmetical purposes, although many of the mineral waters, used at that time, were rich in dissolved gases to which their medical properties were attributed.

Whether the Romans used humus for process of healing, as is supposed to be done to-day in India and Spain, is not clear from the existing literature. Claudius Galenus writes in his works that he saw humus used in Egypt in cases of dropsy with good results, and further that it was also used in cases of painful inflammations.

The baneologists de Dondis in the fourteenth century, as well as Savanarola and de Montagnana in the fifteenth century, highly recommended the use of humus from Abano, and we find thus related, cures for muscular lameness and nervous diseases, but the humus was only used as poultices and not in baths. Such baths and uses of humus was soon copied in France, but the use for same in Germany became only general in the last country.

The first uses of peat for medical purposes in the regions East of the Rhine appear to be in Bohemia. Originally it was only used locally and as poultices, but later it was used as baths and copied by other places, firstly in Marienbad, which was followed by Franzensbad in 1827, which then gradually attributed to these places greater remedial powers. Then quickly followed many more places where there were peat deposits in the neighborhood and which showed curative properties.

H. P.

THE OLDEST USES OF PEAT.

(Extracted from Oest. Moorzt., 1912, Vol. 13, p. 104.)

In the fifteenth century, in the year 1458, Cardinal Aeneas Sylvius wrote about the use of peat in Friesland as follows: "The country is flat and marshy, filled with grasses but is poor in wood, yet they make fires from a slimy earth and dried cow dung." From that time on peat has been in general use and we find it frequently mentioned in the literature from those parts. Also in Holland it has been equally long in use for feeding fires, and we find reference of its case for preparing foods, bread, beer, bricks, burnt stone, lime, etc.

For domestic fires the inhabitants built up piles, like towers, only out of peat, which had the disadvantage of burning very slowly, so that, as H. Degner stated in 1731, when one's feet are cold in winter, one becomes impatient during the time one has to wait till the peat is glowing enough to throw out heat. Whilst in Holland wood was mixed with the peat to start a fire, which very quickly became glowing and was considered a great advantage over the preceding method and was called "de Hollandse patientie."

Peat coke was considered superior to charcoal and we read that peat coke put in a fire glows easily and quicker than charcoal and gives a good constant heat which holds out a long time, and if enough is used the highest temperature can be obtained.

Early in the eighteenth century it was found that peat coke could be used in cooking stoves to far better advantage than charcoal, and it was recommended for this purpose, and in the literature we find that whilst charcoal fires in cooking stoves only lasted six hours, peat coke fires would be kept going all the winter, as the coke burnt slower and the ashes protected the unburnt portions over night.

It was recognized at this time that the ash from peat could not be used for similar purposes as wood ash, but there was considerable use of the same as a fertilizer. At the same time

the fine peat (peat powder) and the dust from the chimneys where peat was burnt, was used to fertilize clayey soils and make them loose. In swampy lands walls were built of peat, which became very hard and efficient after drying out. We read that in some cases the poorest peasants built their houses from peat, and in several cases the roofs of houses were covered with peat instead of straw. H. P.

ANNUAL MEETING, 1913.

The contest on the three places—Chicago, St. Augustine, Fla., and Montreal—to be voted upon by the members of the American Peat Society, is becoming quite lively. Whilst we are going to the press Chicago is in the lead, closely followed by St. Augustine, and Montreal left behind. Our Western friends almost voted as a unit for Chicago.

In this regard it may be stated that it is of great importance to meet at a place where some practical demonstration in peat fuel or peat gasification can be shown, or some drainage work or agricultural development can be seen.

We need not to confine ourselves to the above three places which were simply recommended. The New York Annual Meeting left the selection of a suitable place in the hands of the Executive Committee.

Our members and friends are requested to reply to the letter below, which has just been received:

"To the Journal of the American Peat Society.

"Dear Editor: In regard to the three places mentioned for the next peat meeting, we would see a good thing in Florida, provided the proposed Mond Peat Gas Producer with recovery of Sulphate of Ammonia will be in operation, or the projected peat-briquette plant running an a commercial basis, but I think Florida is too far away, and too costly a trip for many.

"I do not think we want to go to Canada so soon again after our meeting there, still we would find something doing in the neighborhood.

"For the present Chicago does not offer any advantage to peat interests. I would suggest that our members and friends of the three places write to this Journal setting forth what can be seen and learned there. Then other places should be proposed which may offer greater advantages. Our annual meetings should be instructive, and practical knowledge gained in industrial and agricultural peat development.

"AN ACTIVE MEMBER."

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Coincident with the New Year we announce the incorporation of the American Peat Society as a "Membership Corporation." Most of us have had to deal with law and lawyers and will fully appreciate the simple but ever-delaying red-tape, which must necessarily accompany such undertakings. However annoying delays by red-tape are to our mental comfort, yet in organized society they are, to a very large extent, a necessity to prevent abusive use of privilege extended to the community at large. May we hope that this new step will further advance the benefit of our Society to the North American Continent and enhance the value of the Society to our members. Regarding the latter part, the members themselves are the greatest factor, because we can only progress by co-operation, and the more who realize this the greater will be the virtues and benefits of our Society. H. P.

In this issue we print an inspiration from the pen of Robert Ranson. The article shows an awakening interest in making use of our uncultivated and extensive peat deposits. The assertions are fully borne out by results previously published in this Journal. (See Vol. 4, p. 172, and Vol. 5, p. 1.) Robert Malthus, who, in 1798, defined that population increases in a geometrical progression and means of subsistence in an arithmetical ratio, might have found here a partial solution to his pessimistic theorem. Malthus's solution of getting rid of population by means of war and other means of killing is not by

any means as hero-like as increasing the means of subsistence, although the former might be most popular in the minds of hero-worshippers. Mother Earth, who has ever been grateful to mankind, is gradually opening up the latent virtues of peat humus to the agriculturalist's mind. H. P.

We are authoritatively informed that the plant, now being erected by the Societa per l'Utilizzazione dei Combustibili Italiani at Codigoro, Italy, for the production of power and ammonium sulphate from peat, will be the most important one in the world, as it will handle 120 tons of theoretically dry peat per day. The Mond process will be used in this plant and will contain all the improvements which the plant at Pontedera has suggested. H. P.

The Kaiser Wilhelm Institute for Coal Investigations of Muelheim. On Sept. 19, 1912, the senate of the Kaiser Wilhelm Institute for Scientific Coal Investigations adopted the plan outlined in Emil Fischer's lecture of July 29th, 1912, wherein he advocated the use of peat as fuel. He further dealt with the probability of converting the tar, by means of hydrogen, into substitutes for petroleum and benzine. Improving producer gas by converting the carbon-monoxide into methane, through catalytically activated hydrogen, a process which could be advantageously applied to illuminating gas and thus preventing the poisonous effects of carbon-monoxide. The lecturer referred to the various uses of peat for agricultural purposes, which are of as much importance as the fuel value of the same. H. P.

Peat Imports Into Austria-Hungary, 1911:—

Imported from	Quantity in 100 lbs.	Value.
Germany	48,373	$14,606
Italy	112	34
Switzerland	2,252	680
1911	50,737	$15,320
1910	49,225	15,254
1909	58,987	18,279
1908	63,570	20,205
1907	43,898	14,049

H. P.

CONTEMPORARY LITERATURE.

Aleph Anrep. A Standard Bearer of the Swedish Peat Industry, Alf Larsen, in the Jour. of Canadian Peat Society, Vol. 1, p. 3, gives a review of the life of this well-known and successful peat engineer, Aleph Anrep. H. P.

European Peat Societies. H. V. Feilitzen supplements A. Anrep's article (see this Jour., Vol. 5, p. 125) with further details of the more important Societies in Europe. (J. Can. Peat Soc., Feb., 1912.) H. P.

Peat Industry in Holland. Until within recent times peat was the only fuel used in Holland, and on this account many bogs have been practically drained of peat. This is especially noticeable in the Province of Gronigue, where to-day the depleted bogs are turned into fields for cultivation of potatoes and wheat. Peat fuel, however, still forms a large commercial article, and its yearly value is estimated at $603,000. The market for the peat fuel and briquettes is entirely domestic. Despite the decrease in the employment of horses the peat litter industry is growing and it is taking the place of straw in stables. (J. Can. Peat Soc., Feb., 1912.) H. P.

New Peat Power Stations in Hanover. According to the Zeit. f. Verwertung der Kalizalze, Aug., 1912, it is intended to establish a power plant in connection with the Brutanger deposit and a second one in the Stader neighborhood near Bremervoerde. When these are completed it will mean that the largest part of the Province of Hanover is supplied with electricity from peat. H. P.

The Action of Peaty Water on Cement. Tests made by the Society of the German Portland Cement Industry are now far enough to be published. The following conclusions were arrived at: (1) The hardness was in every case less in peaty water than in fresh water. (2) The corrosive action of flowing peaty water was greater than still peaty water. (3) The use of peaty water for mixing the cement showed the same qualities as the fresh water mixed cement. (4) The mode used for mixing the sand influenced the hardness very much. H. P.

Use of Peat in Russia. The Moscow Society for the Promotion of Industry and Manufacture have formed a commission to study the methods of handling, treating and using peat. On account of the enormous peat deposits in Russia, the rational use of same should be of importance. The following questions will be studied: (1) The preparation of the deposit for working same. (2) Chemical composition and calorific value. (3) Existing types of peat machines. (4) Motive power of peat machines. (5) Drying of peat. (6) Transportation and storing

of peat. (7) Division of work time. (8) Fire boxes for peat. (9) Use of peat in Generators.

Gas generators for fuel are already in use in some localities, but difficulties have been encountered on account of the dust and other impurities in the gas getting into the engine. H. P.

Peat Rolling. Dr. Feldt, Instructor of Peat at Koenigsberg, Germany, writes in the periodical "Georgine" about the effect of rolling on peat deposits. He states: The higher the humus content of a peat deposit the greater the absorbability of water, and the more water a deposit absorbs the more the circumference grows. The absorbed water freezes and expands still further. In thawing the water evaporates and the particles expanded by the water and frost remain in the same place in a loose condition. It is therefore no wonder that the deposits richest in humus suffer the most from frost. The effect is most noticeable on the only partly decomposed and naturally loose peat mossy soils which have become dusty with time, less, however, on the more solid and moist grass deposits, especially when it is moist. Whilst only partially successful results are obtained by rolling ordinary soils, it is absolutely necessary on peat deposits. In spring the deposit is soft and the grasses easily give way by treading on them. The plants that are left after frost are only exposed to the drying effect of the sun and wind. It is painful to see that some of the peat surfaces after thawing are harrowed. If we would take the trouble to investigate what good the harrowing has done, we would soon find that it is nothing; on the contrary the good grasses and clover, which have been saved by the frost, have been entirely torn out. The experience obtained on clay soils cannot be applied to peat deposits. The clay soils have to be aerated, from peat, the excess of air has to be driven out. Let it be said here that all good grasses and clover grow better when they find a little resistance in the soil, in other words, they require a more solid rather than a too loose soil. We are reminded of the superior stigmas, found in the autumn, on the plants which grow on and near the well-trodden footpaths. Therefore no harrowing and loosening of the soil, but rolling and pressing the same. The best time for rolling is when plants start to grow and when they are somewhat dry, but it does no harm if they are already several inches high. A stronger growth is the first effect of the rolling, and a healthier cultivation of the grasses, especially clover.

It is just as necessary to roll the peat in autumn as it is in spring, as it has been shown that deposits rolled in the autumn do not suffer as much from the effects of the frost as other unrolled deposits.

The cheapest rollers are made by taking a cylindrical sheet iron drum, filling it with concrete and providing an axle through the center. H. P.

Peaty Swamp Lands. C. G. Hopkins, J. E. Readhimer and O. S. Fisher. Illinois Agri. Expt. Sta. Bul. 157. July, 1913.

There are many thousand acres of peaty land in northern Illinois, much of which produces almost no crops because the soil is deficient in the element potassium, although it is rich in all other elements of plant life.

On the experiment field near Tampico, the peaty swamp soil with the addition of potassium produced 41 to 55 bushels of corn as an average of the years 1902, 1903 and 1904, whilst with no potassium no ear corn was produced. On the experiment farm near Momence the peaty soil treated with potassium gave an average of 44.6 bushels of corn for 9 years, whilst without potassium a yield of only 3.6 bushels was obtained. Some of the peaty swamp soil will improve with the right kind of cultivation, and finally become very productive soils which will not require the continued use of potassium, while other kinds will probably always require potassium applied. Other kinds of peaty swamp soils after years of cultivation are found to resemble sand ridge soils, which is most deficient in the element nitrogen, which, however, can be otbained from the air at very slight cost by means of suitable leguminous crops. Certain kinds of farm manure produce fairly good results on some peaty swamp soils, but commonly it is better farm practice to use the manure on other kinds of soil and buy potassium for the peaty swamp soils.

There is no more profit in starving plants than there is in starving animals, while heavy applications of potassium must sometimes be made at first, with proper management only light applications will be required after a few years. H. P.

PATENT LITERATURE.

Peat Coking Process. German Patent Application C 20348 of Feb. 19, 1912, of the Chemische Fabrik Pluder G. M. b. H. has been rejected. The patent claimed a process for the coking of wood and peat, thereby designated that the apparatus was heated to the temperature, where acetic acid distillation would then proceed without any further application of heat and finally coking by the addition of external heat. (See this Jour., Vol. 5, p. 52.) H. P.

Fuel Briquetting Plants. T. Rigby and N. Testrup. British Pat. 14,624 (1911).

The patent relates to the means of conveying dried powdery

fuel, such as peat or lignite, from the driers to a briquetting press without risk of explosion. The driers are arranged so that only a limited quantity of air is admitted to them, or flue gases may be introduced. The dried fuel passes to the inlet of a centrifugal fan, to which steam or moist air is also admitted, and the fan delivers it through a steam-jacketed conduit leading to the neighborhood of the briquetting press. The fuel is separated from the blast by means of a cyclone separator. Combustion products instead of steam may be admitted with the dried fuel to the fan. (Through J. Soc. Chem. Ind.) H. P.

Commercial Utilization of Peat. N. Testrup and T. Rigby. British Patent 17610 (1911).

This invention relates to the commercial utilization of peat and has for its object to provide an improved process which shall be wholly independent of the usual air drying and need of a large amount of labor necessarily of a cheap kind and which shall therefore allow of the utilization of peat on a large scale and under adverse climatic conditions. A further object is to provide a process of great flexibility in being capable of adjustment of the form of its output without interruption or change of the process and in accordance with any particular demand. A process for artificially rendering the bound water of raw peat free and therefore of allowing drying to a low-moisture content has been proposed by Ekenberg Patents and in the process according to the present invention the former occurs as a step. Broadly speaking, this invention consists in a process of peat utilization by production of ammonia and fuel therefrom in which the peat is wet carbonized by the Ekenberg process, the bulk of its liquid matter then removed by internally transmitted pressure as in a filter press, and a further quantity removed by externally applied pressure as in a band press or by a waste-heat method utilizing products of combustion from the process, the partially dried residue being then in at least such quantity as is needed to supply the power and fuel for the process, gasified in an ammonia recovery gas producer, the remainder being, as desired, also gasified or converted into solid fuel. The invention also consists in apparatus suitable for carrying out the above process.

The following are examples of the application of the process: Example 1. Peat excavated, put into disintergrator, pumped therefrom through pipe line to pulp reservoir, passed to disintegrator, thence to pressure pumps, through carboniser to pulp reservoir, thence to filter presses, effluent passing away, and cake (68 per cent. liquid, more or less), passing to band press, effluent from which passed away and cake (55 per cent. liquid, about) divided one part to gas plant yielding tar, sulphate of ammonia and gas for heat and power, and the other

part to a disintegrator, thence to Schultz driers (exhaust steam heated), vapors therefrom passing to producer grate and peat dust to briquetting press. Example 2. Same as Example 1, but press cake (68 per cent. liquid) disintegrated, dried in combustion gases, dust (55 per cent. liquid), divided, one part consolidated to cakes and passed to producer, an other part sent to Schultz driers, vapors from latter passing to producer grate and dust to briquetting press. Example 3. Same as Example 1, but press cake (68 per cent. liquid) divided, one part disintegrated, dried in combustion gases (say to 41 to 46 per cent. liquid contact) passed to Schultz driers, vapor from which passes to producer and dust from which briquetted portion of resultant briquettes being admixed with remainder of press cake and mixture supplied to producer. Example 4. Same as Example 1, but material from band press (55 per cent. liquid content) all gasified and excess gas over needs of the process employed in power plant to yield electrical energy. Example 5. Same as Example 3, but peat dust (41 to 46 per cent. liquid content) consolidated in briquette press and resultant briquettes admixed with the press cake (68 per cent. liquid content), and whole gasified, giving sulphate of ammonia and tar with excess of gas to be converted into electrical energy.

The patent is profusely illustrated. H. P.

Drying Raw Peat. H. Brune and H. Horst. Canadian Pat. 137,963, Jan. 23, 1912.

The process consists of mixing hard dried compressed peat with raw peat and pressing this mixture. This admixture of hard dried peat to the raw peat is supposed to give the raw peat the property of giving up the whole of the water it contains when it is pressed. H. P.

Peat Moulding and Spreading Machine. A. Anrep, Canadian Pat. 141,700, Sept. 3, 1912.

The machine compresses a filling frame resting in front on one or more rollers and at the rear on the moulding frame. The latter is connected with the filling frame by means of a pivot shaft or hinge adopted to swing upward and to trail on the drying ground when the machine is dragged forward.

The mould board which has for its object to smooth and mould the peat cake without dragging it or tearing it into pieces, is horizontal or nearly so. At the rear end of the machine are movable dividing tongues or fingers on which are cutting knives intended to divide the peat cake into strips. The rollers in front serve to compress and level the drying ground in advance of the moulding apparatus, and also furnish centers of rotations when the apparatus is turned. A horizontal screw in front of the moulding frame, which is rotated by the shaft

of the rollers, divides the peat and gives it the desired thickness before it arrives under cover of the moulding frame, which by means of its horizontal cover exerts a vertical pressure on the peat mass, producing a good and uniform moulding action.

H. P.

Dewatering Peat. H. Keeble and A. C. Keeble, Canadian Patent 142,519, Aug. 27, 1912.

The disadvantages of separation of wet carbonized peat and its associated water, by pressure are claimed to be overcome by interposing between the material and the water exit several layers of wire gauze maintained in close contact with one another and held firmly between smooth metal or other hard surfaces, so that escape of expressed water must be through portion of the gauze layers gripped between such surfaces. It is stated that two layers of gauze suffice with a fineness of 30-90 mesh.

H. P.

Peat Treating Apparatus. A. Anrep, Canadian Pat. 142,632, Sept. 3, 1912.

Peat is treated in the machine in such a manner that the roots and fibres are cut, and thereafter subjected to an intense cutting between movable and stationary knives and afterwards pressed through a kneading and mixing apparatus, whereby the final product acquires uniform plastic properties, so that uniform moulding is possible while the contractibility of the peat during the drying operation is considerably increased, and a heavy and hard product obtained, which is not very absorbent of moisture.

H. P.

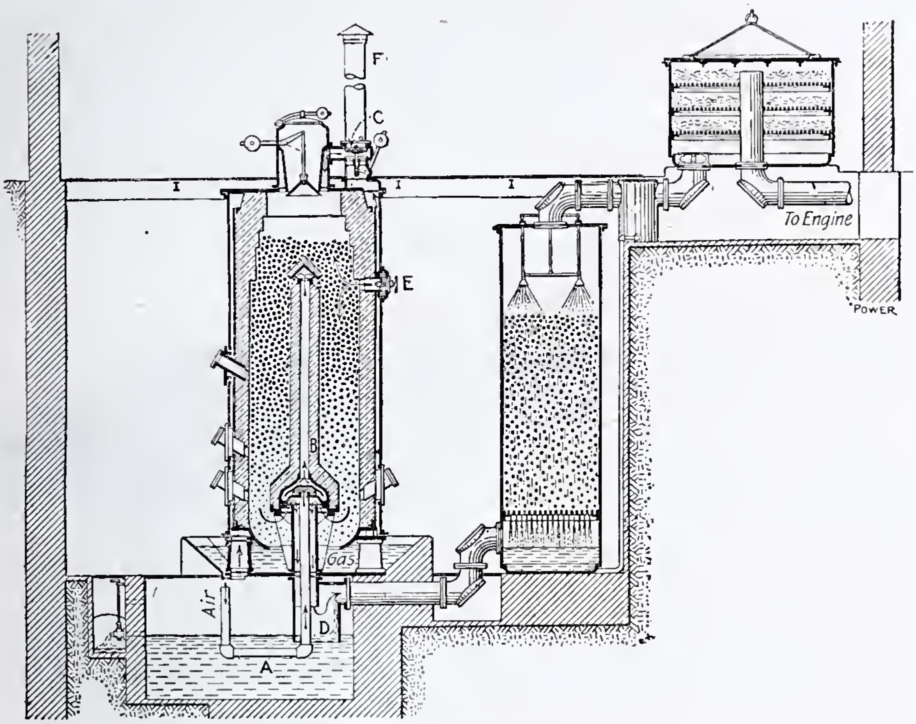
A German Peat Gas Power Plant. Paul C. Percy. Power, 1912; Vol. 35, p. 53.

At the East German Exhibition which was held some time ago at Posen, a complete peat-gas power plant in full operation attracted a great deal of attention. The producer was the Heinz apparatus, described last June in "Power," and the engine was a horizontal single-cylinder, double-acting machine, designed especially to work on the variable quality of gas characteristic of peat gasification.

The engine is rated at 300 h. p. and was used to drive an electric generator which supplied current throughout the exhibition hall.

The figure shows a sectional view of the producer outfit. The gas generator may be considered as in the down-draft class, but differs in several important respects from the ordinary down-draft type in general use. The air is taken from the pit beneath it, which also contains the scrubber water and the gas-delivery pipe D. Part of the air is drawn through the pipe A and the superheater B into the upper part of the fuel column, whence

it must travel down through the fuel bed in order to reach the gas outlet below. The remainder of the air ascends through the space between the outer and the inner shells of the generator, absorbing radiant heat, and under normal conditions it enters, through the valve C at the base of the purge pipe F, the combustion chamber above the fuel bed.



Gasification of the fuel takes place in one direction only, and the gas is withdrawn from the center of the combustion chamber below. The air, instead of traveling along the walls of the generator, is forced to enter the inner strata of the fuel bed. The heavy gases produced in the upper layers of the fuel bed are forced to pass through the incandescent zone below, where they are split up and converted into light and permanent gases.

If the water content of the peat exceeds certain limits, somewhere around 40 per cent., an auxiliary process is employed temporarily by starting a second combustion zone near the top of the fuel bed. This is done, by opening the pipe F and the auxiliary air-inlet valve E, as soon as the attendant notes that the fire on top of the fuel column is disappearing. The valve C then closes automatically and the air which is preheated in the space between the shells enters the fuel bed directly through the valve E. Thus combustion is started at the level of E both ways, the up-draft being provided by the pipe F serving as a chimney and the down-draft by the suction of the engine.

As soon as the incandescence is re-established on top of the fuel bed the purge pipe F is closed off and the valve E shut; the normal process is thereby resumed. By the temporary employment of this expedient, fuels of very high water content can be gasified. Of course, there is a moisture limit, for in peat containing 80 per cent. of water the 20 per cent. of combustible would be only sufficient to vaporize the water and no combustible gas could be produced. With the auxiliary process the consumption of fuel per horsepower-hour becomes somewhat greater than normal, but the operation is very simple and free from troubles.

In this producer all the gases emanating from the scrubber water are drawn up with the air into the combustion chamber and destroyed. The gas produced is very clean.

H. P.

FUEL MANUFACTURE IN MEXICO.

According to a report from the British Legation at Mexico a contract has been made between the Ministerio de Fomento and Mr. C. G. Teruel for the establishment of five or more factories for the production of fuel from petroleum, benzine and residual oils, in combination with peat or vegetable pulp. The contractor is to invest not less than $100,000 gold in the equipment of the first five factories, for which the plans are to be submitted within six months from the publication of the contract. The factories are to be completed within three years after the approval of the plans.

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Some Advantages of the Use of Peat Litter and Peat Dust

(Compiled from various sources, including the St. John's, N. F., Royal Gazette, 1910.)

The manufacture and sale of peat litter for stable bedding and peat dust have been thriving industries in Europe for a century. Peat litter, like straw, is quoted regularly in the markets of most countries of Europe. With the finest peat moss deposits in various parts of this country it is strange that no well-supported attempts have ever been made to establish so profitable an industry here.

At the present time, and for several years past, about 9000 tons of peat moss litter are annually imported to this country from Holland, most of which is used in stables in and near New York, Boston, Philadelphia and Baltimore. It is sold at prices varying from $12.00 to $16.00 per ton according to quality. It would be easy to manufacture, in many parts of the United States, an article fully equal, and mostly superior, to that imported, at an estimated cost of about $4.00 per ton, which would seem to promise large profits. Freight, duty and sundries on the imported peat litter alone cost from $3.00 to $5.00 per ton, which is more than it would cost to produce a superior quality in this country.

Moss Litter and Peat Dust.

These are both of loose, puffy and elastic, or readily yielding, consistency, of great absorbing power, and are made from poorly decomposed fibrous and mossy brown peat; they are

both bad conductors of sound, heat or cold, and are antiseptic and germ destroying.

Peat litter for stable bedding affords a comfortable, dry and elastic bed, free from dust and odor. It envelopes the solid matter of the animal droppings, absorbs all moisture, retains and fixes the gases of decomposition. It increases the quantity and improves the quality of the stable manure, since it prevents the decomposition of the nitrogenous organic matter and consequent loss of the valuable ammonia. The litter must at all times be stored in a dry place.

Until the animals get used to this very superior bedding it may be advantageously covered with straw. All drains should be carefully filled up with it so that all urine may be absorbed and when thoroughly saturated the wet material should be replaced with dry; the urine once absorbed will not decompose, and with the peat produces an excellent manure. Drains may be altogether omitted in new stables when this type of bedding is used and the floors can be constructed on a perfect level, because all liquids are quickly absorbed by the peat, which prevents decomposition and thus fixes all ammonia and subdues all noxious odors.

The hoofs of the animals which stand in this bedding attain to a degree of flexibility and soundness which can be compared only with the condition of pasturing animals. The stamping of the animals standing in the stalls is noiseless owing to the softness and resiliency of moss litter. The daily cleaning out of the manure is not necessary, as it may be left for weeks in the stables without the least ill effect. The temperature in the stables is lower than where straw or other litter is used, as the peat litter prevents the "heating" or decomposition of the manure.

Animals that have not lain down for months or years on straw or shavings, when peat moss litter is placed under them usually avail themselves of this soft and spongy bed, and lie down to sleep and rest; their legs are never cooler or finer than when peat is used for bedding and those that are fevered, bruised or brittle soon get well again after it is introduced in the stable.

While straw, sawdust, wood chips, and similar quite unsuitable materials take up only 2 or 3 times their weight of urine or water, and are not deodorizers, good peat moss litter absorbs from 8 to 12 times its own weight of moisture, viz., 100 pounds of the litter will absorb from 800 to 1200 pounds of liquid before it is saturated, and, even if saturated with urine, the usual strong odors of ammonia and other products of de-

composition cannot be detected, or are but slight when compared with those given off from straw or shavings similarly treated.

Because it has this property of preventing the decomposition of urine, peat litter keeps the atmosphere of a stable pure and odorless; this power of arresting decay which prevents the formation of ammonia and its carbonate is of course one of the most important recommendations for the use of peat as stable bedding. It not only minimizes the liability to diseases of the eyes, lungs and hoofs by keeping down the noxious gases but adds to the value of the manure by preventing their formation from the nitrogen compounds. Bulking less than any manure made of straw or shavings, it takes up less room, viz., it requires only 350 cubic feet for the yearly manure of a horse or cow, whereas over 850 cubic feet are needed for straw manure. A horse needs about 80 pounds of peat litter per month; a bed for horses lasts from 4 to 5 weeks.

Selection of a Peat Deposit for Making Peat Litter.

Care should be taken in selecting a peat-moss deposit for exploitation, as it will greatly damage the reputation of the article on the score of injury to the eyes, if an inferior, imperfectly dried, dirty, dusty and earthy quality of litter is put on the market. But this can only be the case when the wrong raw material is used and where the product sold is not of the fibrous and clean, sieved sort, or is unfit for bedding, owing to the quantity of muddy, make-weight substance resembling dried bog soil. There also exists a hairy, wiry variety of surface peat which is utterly useless and worse than useless for bedding purposes.

Peat Litter for Cows and Other Live Stock.

Cattle like to rest on it, and it possesses the same valuable properties for their stables as those for horses, and should be very valuable in dairy barns, because it keeps down the odors to a minimum. Cows and bullocks need about 100 pounds of moss litter yearly for 100 pounds of living weight; less is required for draught animals and others which do not remain in the stables during the day. A peat-litter bed for cows lasts from 2 to 3 weeks, if they stand on it all the time.

When used as bedding for pigs, the skin of the animals remains free from inflammation, by which perfect health is assured. Quick increase in weight secures larger income. The manure remains dry, as peat litter completely absorbs all urine. Where pigs are bedded on peat, the well-known and malodorous

smell caused by butyric acid, usually characteristic of pigs, is absent from the pens.

In the sheep fold only the top layers of the bed need changing, and these but once a year, where peat litter is used.

Peat Dust in Poultry Houses.

Diseases are unknown where the floors in poultry houses are covered with peat dust. Peat being antiseptic no germs can develop, and it is excellent for making nests. The fowls delight to scratch the material in search of grain, and to burrow in it, thus keeping themselves clean and healthy. Parasites are warded off, and the droppings are soon worked up into impalpable powder and mixed with the vegetable matter of the peat dust so that the resultant manure becomes valuable for the garden, and is very high in nitrogen compounds.

Use of Peat Dust in Animal Cages.

By the use of peat litter in the cages of animals confined in menageries and zoological gardens, the obnoxious smell so common in such places will disappear, the air will be purified, and the animals will be healthier than with any other bedding.

Peat Dust in Markets, Fish Houses, Etc.

In the hurry and bustle of fish packing and drying along the coast, hundreds of thousands of tons of entrails, offal, and even cod roes, are yearly wasted or thrown into the sea. There is an enormous waste of most valuable fertilizing material in connection with our great fisheries.

By the simple process of mixing the offal with peat dust, fortified with an addition of 2 per cent of sulphuric acid or a small amount of copperas, or ferrous sulphate, pressed and dried, this product would easily realize from $25.00 to $40.00 per ton in the open market.

The value of fish manure is unquestionably one of the most important features of our fisheries and of agriculture, and its production could undoubtedly be extended with profit, if properly prepared peat dust were more extensively used.

Peat Moss and Peat Dust in Sanitation on the Farm.

The manures obtained from night soil mixed with peat, as well as peat farm-yard manure, have considerable commercial value, more especially turning the former into a cleanly and powerful plant food. The profitable utilization of night soil in agriculture is therefore not only practicable, but from a sanitary point of view, absolutely safe; rightly applied the mixture will produce golden harvests on the fields.

Rivers of fertilizing riches run to waste from the ordinary farm-yard or field manure heaps, whereas these liquids cannot escape from peat litter, and the value of this retention of urine in the heap may be appreciated when one considers that urine, putrifying for a month, contains double the ammonia of fresh urine, and that unless mixed up with peat it loses this ammonia, which escapes in the air.

A cow's urine for a winter, mixed up with peat as it is daily collected, is sufficient to manure half an acre of land with twenty loads of manure of the best quality, while the solid evacuations and litter for the same period afforded only 17 loads, whose value was not half that of the former.

Experiments conducted by the Berlin authorities with the object of testing the effect of the sewerage of their town on the barren soils in their vicinity, established the fact that if a soil without manure yields a crop of 3 for 1 sown, then the same land dressed with cow dung yields 7 to 1 sown, with horse dung 10 to 1, and with night soil treated with peat dust 14 to 1. The reason of this striking increase is based on two causes, firstly, because human manure is, as a result of the mixed vegetable and meat diet, nearly one-third more effective than animal manure; and secondly, because of the extraordinary power peat has of absorbing and retaining ammonia and its carbonate.

Malodorous and dangerous gases cannot escape from peat dung at an ordinary temperature, because peat itself is a greedy absorber of gases. All night soil from vaults or cesspools evolves ammonia; hence the advantage of mixing peat with the material before drying it. The same applies to fish and other animal offal as already pointed out and of course ammonia is one of the most potent manures known and the best purely nitrogenous material for all crops. In kitchen gardens and orchards only favorable results were obtained with night soil mixed with peat; when used with asparagus, raspberry and gooseberry bushes, all kinds of vegetables, radishes, cauliflower, etc., it produced, besides delicious and beautiful fruit, an increase in the crops gathered of from 50 to 100 per cent compared with an equal quantity of stable manure. A field of turnips produced 96 per cent more, manured with night soil and peat, than with straw manure, while the quality was the same.

Peat Litter and Peat Dust for Plants.

For potted plants in dwellings, a layer of one inch on top of pot, soil in heated rooms, especially for palms, ferns and other tropical plants, will improve the soil, keep it moist, and protect the plants against cold and freezing.

For Soil Improver in Hot Houses and Nurseries.

Peat dust mixed with the soil will improve the health of plants; it also may be used advantageously in planting trees and bushes in heavy, loamy and dry soils. A covering of peat dust will be found excellent to protect garden plants from frost, at the same time preventing the plants so covered from becoming rusty or mildewy, and for propagation beds in nurseries, etc., because it maintains a uniform heat and prevents putrefaction, the shoots grow more quickly and the formation of roots is excellent. Peat litter for drainage and as filter and purifier has given most satisfactory results, but it has to be specially prepared for these purposes.

Peat Dust for Insane Asylums.

Beds are filled with peat dust and covered with linen. Urine is instantly absorbed, and patients remain dry and are protected from cold.

Peat Dust for Keeping Manure.

Peat dust renders excellent service to keep in a pulverized state chemical manures, such as superphosphate, kainit, and other like substances which attract water.

Peat Dust as a Sound Damper.

For partitions, light walls, music halls, bowling alleys and between floors, peat dust and moss litter are, as a rule, filled in loosely between double walls for deadening sound. Doors made of compressed peat have proved useful for telephone booths. As a filling for ceilings, moss litter, which, for this purpose, should be saturated with milk of lime, and then well dried, has proved very useful. One cubic yard of peat dust will cover 25 cubic yards, three inches high.

Peat Dust an Excellent Disinfectant in Closets.

According to official reports, among the 564 towns with a population of over 10,000, in Germany, peat closets were used in 212 towns during the year 1909. A great deal has been done in Sweden to increase the use of peat dust as a disinfectant during the last few years, while self-acting dry peat closets are frequently to be met with on the European continent, where many towns make the use of peat dust in closets compulsory.

The prime cost of erecting the necessary plant and works for handling the sewerage of a town having about 60,000 inhabitants by using peat dust amounted to only $50,000. The vessels from the house closets are collected at regular times and

drawn from the town to the treating plant on special carts; at the sewerage works they are taken to the first floor of the building by means of an elevator; they are emptied automatically and taken to a cleansing apparatus where they are treated with peat dust and steam. Behind the cleansing room is the storage shed for peat dust, which is brought in carts from the peat works situated about 3½ miles distant. From the peat-dust shed a conveyor leads to the apparatus for the mixing of the manure, which consists of a horizontal cylinder provided with a screw.

The finished manure is removed to the manure shed by means of a screw conveyor and from here it can either be loaded directly on to trucks by means of dump cars, or stored in the lower part of the shed, for sale in the neighborhood. The price of this manure was $2.35 per ton in the open market.

The vessels are painted once a month with coal tar; a 20 H. P. steam engine furnishes the electric light for the plant, as well as power for the mixing and cleaning apparatus. The material obtained through mixing the excreta with peat is odorless and of a moist, powderly consistence, and may be taken into one's hand like earth; in fact it seems like, and is, nothing but rather rich mould. It is obvious that such material may easily be removed in open baskets without annoyance to the inhabitants, and this certainty of freedom from foul odors and from evaporation or leakage may be regarded as absolute. In this way all the sewage of a town may be made serviceable for agricultural purposes, and the method is of especial value in inland towns without any natural outlet for sewers and in any case is vastly better than polluting the waters of streams, and wasting valuable fertilizing materials as well.

, Concentrated sulphuric acid or muriatic acid which have been recommended as destructive agents cannot be entrusted to everyone to use as disinfectants and to destroy refuse, as these acids are too dangerous and inexperienced persons may easily do damage with them, while, on the contrary, peat dust impregnated with only two per cent of sulphuric acid is not only quite harmless, but an excellent disinfectant as well.

When we consider that the excreta of an adult person may be used for the production of 275 pounds of grain, representing the food supply of one person for a whole year, we obtain an idea of the advantage offered by the use of peat dust for the purposes of disinfection and manure; it is not merely the only real means of sanitary disinfection but is also of two-fold value from a pecuniary point of view, because on the one hand it represents a great saving, and on the other hand it forms a source

of income, whilst by the use of all other systems of sewerage disposal, the inhabitants are put to expense only and cannot expect any revenue.

Peat Dust for Packing of Fruit, Vegetables, Fish and Meat.

For packing, preserving and transporting perishable foodstuffs, such as fish, meat, eggs, butter, etc., on account of its great elasticity the danger of these articles or their wrappings being broken is reduced to a minimum by the use of peat dust, and it is practically impossible for articles thus protected to become tainted or to decay.

Any kind of provisions packed in peat dust may be stored over winter or transported over long distances. They will keep fresh and never rot in transit; thus fish packed in moss litter proved to be as fresh, after a long journey of 18 days, as when it had just been taken from the water.

For the storage of fruit, grapes, turnips, potatoes, onions, etc., during the winter, properly prepared peat dust is found to be excellent, and, fruit packed in boxes with the dust keeps its fresh appearance for months without becoming stale or rotten, and turnips, potatoes, onions, etc., are preserved equally well and they do not sprout prematurely when thus stored.

Peat Dust for Stock Foods.

Peat dust is used on a very large scale to mix with molasses for feeding the latter to horses, cattle and other live stock and the mixture is very satisfactory as a tonic and fattening ration.

Peat Dust as a Disinfectant in Public Places, Hospitals and Dwellings.

In hotels, saloons, ferries, waiting rooms, bath houses, freight stations, hospitals and dwellings, this material will absorb all obnoxious odors, purify the air, and produce a refreshing, spring-like atmosphere.

As a packing and filling material loose peat renders at least the same service as wood, wool, straw, etc., on account of its great power of absorption and its antiseptic properties. Moss litter and peat wool form a suitable filling for bed bolsters and mattresses and especially desirable for women and children.

Peat Dust for Ice Houses and Protection Against Freezing.

Peat dust is the cheapest obtainable article for preventing ice from melting, as it is an excellent non-conductor and articles covered with it are but slightly affected by change of temperature.

Peat dust also renders excellent service, when used rightly,

for quickly drying up damp walls; it is used to cover ice houses, cooling and heating chambers, hatching bins, etc. From an ice house erected 2 years ago, the ice stored in it was taken out as late as last summer, although no fresh ice had been laid in meanwhile. Its non-conducting properties made it equally valuable for covering steam and water pipes, tiles, and slabs to prevent the loss of heat or the penetration of cold.

Peat for Sanitary Use in Tenements.

The live, potentially deadly germ-laden dirt of the sofas, couches, cushions and beddings in most lodging-houses, apartments and servants' rooms is, from a sanitary point of view, little removed from that found in the common "Dosshouse." In a paper read a few years ago before the Congress of the Sanitary Institute, at Glasgow, Scotland, by Mr. Peter Fife, Sanitary Inspector of that city, the existing state of the sleeping arrangements of fully 78 per cent of the population, was described as indescribably filthy and unsanitary. For the purpose of ascertaining the kinds of bedding on which the majority of people in Glasgow slept, about 2,300 houses were visited, in which special investigation was made into the composition of 3,163 beds, with the following results: hair beds 22; feather beds 115; clean flock 37; cotton clippings 103; staw 371; chaff 39; shavings 4; old clothes 1; and common flock, 2,471.

This common flock is composed of filthy rags, gathered from every quarter of the globe, the off-cast of all the pariahs of humanity, saturated with the germs of all the ills to which human flesh is heir, In preparing these rags for use only those pieces soaking wet or too damp for the revolving tooth tearing machine, most appropriately named "devil," are cast aside to be air dried. Nothing in the nature of cleansing or disinfection is attempted and all goes with the "devil" if sufficiently dry. At the other end it comes out as "flock," shredded so finely by the spikes or teeth, as to appear a fluffy wool of a dark grey, black or brown hue.

Careful examination and tests proved that the material, as it came from the machine, contained more solids that the crude sewage of the city, the average sewage containing 24.4 grains per gallon whereas the bedding reached 228.07 grains per gallon. This common, unwashed flock costs $22.50 a ton, or about 43 cents per bed.

If the sanitary peat-moss fibre is substituted for "common flock" no insect will be found to harbor in the bedding; it will be found to be comfortable lying and an occasional opening up of the ticking and the exposure of the material for an hour or

two to sun and air are easily accomplished and will preserve sweetness. On the score of cost, the balance is largely in favor of peat, as the peat bed would be much cheaper than that of flock.

Cost of Plant and Production.

The cost of plant and costs of production at a peat litter factory in the United States will greatly depend upon local conditions, but with all items liberally calculated, the following may give an idea of conservatively estimated figures for working operations. The price of air-dried peat, $1.50 per ton, can probably easily be reduced to below $1.00 per ton by using automatic machinery. The items of cost of plant, and daily expense, can also be reduced considerably, when the local conditions are known.

The approximate estimate for a peat litter and dust or mull factory, having a capacity of 640 bales, 64 tons per day of 20 hours, i. e., two 10-hour shifts, would be divided about as follows:

Quantity of Output.

	480	Bales litter each of 200 lbs.	48 tons
and	160	Bales mull each of 200 lbs.	16 tons
	640	Total	64 tons

Cost of

1.	Machinery and storage building, 100 x 50	$ 2,000.00
2.	Power plant (Power gas engine and electric dynamo, 100 H. P.)	10,000.00
3.	2 presses, 1 tearer, elevator revolving sieve, transmission and beltings	4,000.00
4.	Excavator and other machinery for digging and drying peat	4,000.00
5.	Portable tracks and cars	2,000.00
6.	Tools and Sundries	3,000.00
		$25,000.00
	Working Capital	15,000.00
	Total	$40,000.00

Production of the Raw Material.

Digging and drying 19,200 tons at $1.50............$28,000.00

Daily Expense at the Factory.

1 Machinist	$ 3.00
11 Laborers at $2.00	22.00
Fuel	22.00
Wire and material for bales	25.00
Night shift	25.00
	$ 85.00

Which is $1.32 per ton.

General Expenses.

Depreciation on machinery and building, 10 per cent.	$ 2,000.00
Salary for manager	2,000.00
Selling Expenses	5,000.00
Repairs	1,000.00
Total	$10,000.00

Income.

14,400 tons litter at $ 8.00	$115,200.00
4,800 tons mull at 10.00	48,000.00
Total	$163,200.00

Recapitulation of the Expenses.

Raw Material	$ 28,800.00	
Productive labor and expense (300 days at $85.00)	25,500.00	
General Expenses	10,000.00	
Freight charges from factory to consumers 19,200 tons approximately $2.00 per ton	38,400.00	
	$102,700.00	$102,700.00
Net profit, liberally estimated		$ 60,500.00

Delaware Swamps. The state of Delaware, in spite of its small area, contains certain swamp lands which, however, are not being investigated by the State Experiment Station. The Agranomist, Mr. A. E. Grantham, Delaware College Agricultural Experiment Station, Newark, Delaware, will be glad to correspond relative to the culture of muck soils.

LABORATORY TESTS ON PEAT BY VACUUM DEWATERING.

G. Herbert Condict, Plainfield, N. J.

In order to determine whether or not it would be commercially possible to dewater peat down to 70 per cent moisture-content, a series of tests were made by Mr. W. B. Ruggles (Pres. Ruggles-Coles Engineering Co.), and the writer. The equipment for this test comprised a rotary pump, so connected that it would operate either for vacuum or pressure, run by a two-horse power electric motor, a cast iron box, into the top of which fitted a 12-inch x 12-inch porous plate, one inch thick (made by Just Process Co.), with two pipe connections in the bottom, one for attachment to exhaust pump and the other for draining off the water. Both spring and mercury gauges were used to determine the vacuum. Various scraping, pressing, brushing, and stirring devices were provided and two plates of different porosity. There was also a piece of 4-inch pipe, 18 inches long, with a base holding several layers of fine-mesh screen, on which rested a layer of filter cloth.

Many preliminary runs, to determine proper operating conditions, were made. and seventeen recorded tests. The first two tests were made with the plate of least porosity; tests Nos. III to XII with the plate having greatest porosity; tests Nos. XIII to XVI with filter cloth on top of this last plate, and test XVII with the 4-inch pipe.

The highest vacuum secured was 13¾ inches, mercury.

The tests usually ran for 21 minutes, with readings every three minutes. Some of the tests were run for an hour, in order to determine conclusively whether or not the moisture could be further removed, but only in one test (No. VI) was there reduction worth noticing.

The wet material varied in moisture-content in first sixteen recorded tests, between 76 per cent and 87.6 per cent, averaging 83.1 per cent; this material was spread on the porous plate to an average depth of one-half inch.

The best results were secured when the material was constantly stirred and pressed down on the plate with a trowel, but this procedure speedily filled up the pores of the plate, so that it became impervious, and no amount of scraping or brushing would return it to its original condition. It was necessary either to reverse the plate or to apply air under pressure beneath it, in order to clean the pores for the next test.

Another serious difficulty was the stickiness of the peat,

as it adhered most tenaciously to every device used in its manipulation. This rendered almost impossible the uniform spreading of the peat over the entire surface of the plate and also the securing of proper samples for moisture-content determinations.

The test No. XVII, made with the pipe, was entirely unsatisfactory. The pipe was filled with peat "soup," and a vacuum of 11½ inches applied. An impervious layer of peat, about an inch in thickness, immediately formed on the filter cloth, effectively preventing further dewatering.

A layer of "soup," about two inches deep, was then poured into the pipe, with the same result. Water could be squeezed by hand out of the layer of peat next to the cloth.

Apparently it is useless to expect any commercial results from the operation of the vacuum system of dewatering.

Detailed record of the tests follows:

(See next page for table.)

Detailed Record of Vacuum Tests on Peat

Test Number	Percentage of water after being under vacuum.									Vacuum in inches of mercury		REMARKS.
	Min. 0	Min. 3	Min. 6	Min. 9	Min. 12	Min. 15	Min. 18	Min. 21	Min. 39	Beginning of test	End of test	
I.	.....	77.9	.....	78.5	.....	.....	....	.....	.....	10.00	10.00	
II.	83.0	.....	73.0	.....	70.0	.....	68.8	.....	.....	10.00	10.00	Peat was constantly kneaded and
III.	84.2	77.8	76.2	76.2	75.2	74.8	67.4	69.8	.....	4.75	4.75	pressed down by hand and trowel.
IV.	81.0	73.7	72.0	72.0	71.3	70.0	66.9	60.0	.....	11.50	11.00	
V.	83.0	80.0	78.0	74.9	74.1	72.8	70.0	68.5	.....	8.00	6.50	Peat treated as in I-IV and occasionally scraped and turned over.
VI.	82.0	.....	77.2	76.6	74.3	76.2	65.7	62.0	55.0	0.00	0.00	Peat constantly raked by hand.
VII.	76.0	72.0	78.4	75.0	77.7	73.2	73.6	69.7	.....	6.75	6.75	Peat undisturbed.
VIII.	78.8	.....	.....	.....	.....	.....	76.6	.....	.....	1.00	0.90	Peat raked by revolving rake.
IX.	86.1	82.0	82.4	81.1	78.9	.....	....	.....	.....	4.50	3.00	Peat raked by hand and lightly trowelled.
X.	84.7	81.7	79.7	79.2	78.8	79.0	79.2	79.3	.....	0.00	0.00	Peat raked in by hand.
XI.	81.7	76.2	75.1	73.3	73.0	.....	.....	.....	.....	.....	.....	Peat undisturbed.
XII.	86.9	79.7	77.9	79.8	79.5	.....	.....	.....	.....	.....	.....	
XIII.	84.2	78.7	79.4	78.4	78.2	77.2	78.3	77.5	.....	.....	.....	Porous plate covered with filter cloth
XIV.	.....	.....	.....	75.2	76.9	.....	78.4	75.9	.....	5.00	2.00	and the peat not disturbed.
												Cloth on porous plate; peat 1 inch
XV.	84.7	80.5	81.1	79.9	80.6	78.1	.....	.....	.....	2.00	0.75	thick, very wet, at air temperature
XVI.	87.6	83.1	82.8	81.8	81.0	80.9	.....	80.1	.....	1.25	1.25	of 236° to 266° F.
XVII.	90(?)	.....	.....	.....	.....	.....	.....	80(?)	.....	11.50	11.50	Four-inch pipe used.

THE USE OF PEAT IN GREENHOUSE SOILS.

Prof. W. R. Beattie, St. Louis, Mo.

Years ago, when our grandfathers made a hotbed for starting early plants, they went into the woods, scraped away the leaves and procured a supply of leaf mould in which to sow the seeds and start the plants. During recent years the forests have been cut away and we can no longer secure the black woods' earth, which has resulted from the decay of generations of leaves, in sufficient quantities for hotbed and coldframe soils. There are, however, scattered over the country, numerous deposits of decayed peat or muck soils that are vastly more suitable for starting plants than was the leaf mold of our grandfathers' days.

Away back in the eighties of the last century, when the Ohio Agricultural Experiment Station was located at Columbus, Ohio, on the land owned by the Ohio State University, there was a considerable bed of peat upon the farm and this was extensively used as a greenhouse soil. First the pure muck was used for starting vegetable plants for planting in the greenhouses, or in the open ground. The plants made such rapid growth that it was decided to try it in the greenhouse benches for the production of lettuce, radishes, table beets, tomatoes and cucumbers. The soil was mixed with about equal parts of muck, rotted manure and potting soil consisting of decayed sod loam. The results, from the use of this soil, were so marked that on the following year the quantity of muck was increased and that of the loam cut down to a small percentage of the whole.

It would seem to the writer that there is a good opportunity for those who own large tracts of peat soils to create a considerable industry in the sale of this soil for use in vegetable forcing houses. It is extremely doubtful if the muck will give good results for the growing of carnations and roses and it should not be recommended for that purpose until careful experiments have been made. Tests that have already been made indicate that the muck soils do not have the body necessary to give the carnations strength of stem, or the roses strong growth. This difficulty, however, may possibly be overcome by the addition of potash and phosphoric acid to balance the nitrogen already present in the muck.

There can be no doubt, however, regarding the value of muck for mixing with the soils to be used for vegetable forcing. Their cost, and the character of the soil with which they

are to be used, will determine the quantity to be employed. One part peat, one part well-rotted stable manure and one part rotted sod loam has given excellent results and can safely be recommended for all such greenhouse crops as lettuce, cauliflower, cucumbers and tomatoes. Tomatoes give best results, when grown upon a mixture containing muck soil, after one or two crops of lettuce or cauliflower have been grown upon it. This is due to the fact that the fresh muck soil produces too great growth of vine at the expense of the fruit.

In preparing the muck for use in the greenhouse it should be removed from the original bed and allowed to lie in piles for three or four months to aerate. It should then be mixed with the manure and loam and again allowed to lie in the piles for a month or two before placing in the greenhouse. A soil of this character has often been known to give better results the second season than the first. After the second season it should be removed from the greenhouse and allowed to lie in a broad flat pile for a year, then a new supply of fairly fresh but rotted manure added, to give the muck soil new life. After such treatment it is again ready for use in the greenhouse.

If the soil becomes infested with insects or disease these can be eradicated by steam sterilization. Muck soil for use in vegetable forcing houses does not require special treatment, merely being partially dried to cut down weight and then shipped in open or coal cars. If, however, it is to be shipped long distances after drying, it should be forwarded in tight box cars or the loss from blowing out by the wind will be considerable.

Some of the advantages of muck soil for use in greenhouses are: Ease of cultivation and handling, retention of moisture, freedom from disease and power of absorbing heat. Unless the muck soil is extremely dry it will absorb water very readily when the application is made to the surface. Muck soil is also well adapted to the use of sub-irrigation watering in the greenhouse, because the water is readily absorbed and uniformly distributed upon entering the soil through the openings in the pipes or tiles used as distributors. This is an important point, especially with a crop like tomatoes, which form great masses of roots near the surface of the soil. These roots often serve as an impervious layer which prevents the water going deep into a clay soil. In one case brought to the attention of the writer, a crop of tomatoes in a greenhouse was not making satisfactory growth, the fruits being

small and ripening prematurely. To all appearance plenty of water was being applied, but upon examination it was found that this water, applied to the surface, was not penetrating the soil to a depth greater than than 1½ inches, so that the roots in the bottom of the bed could not secure sufficient moisture. This condition would never have occurred if a muck soil had been used as the water would readily have penetrated to the bottom of the bench.

Heavy clay soils are often known as cold soils. On the other hand, muck soil would be considered a warm soil. This is due chiefly to the splendid penetration of the water and air in the muck soil; muck soil being black, also undoubtedly absorbs more heat than light-colored mineral soils. The fact that a muck soil is easily handled and cultivated in the greenhouse it a matter of no small importance, especially where the plants are grown close together as is often necessary in commercial work.

Muck soil can be very easily sterilized by live steam and in this way the weed seeds and disease germs that may be contained in it can be completely killed. All things considered muck is one of the most desirable types of soils for use in greenhouses, for vegetable growing and especially where large numbers of vegetable plants are being grown for winter market.

ONIONS ON MUCK SOIL.

By Elmer O. Fippin, Professor of Soil Technology, Cornell University, Ithaca, N. Y.

(Reprinted from "The Vegetable Grower," Chicago, Ill.)

Truck crops which are used for their vegetative parts require that their growth take place under the most favorable conditions if they are to have good quality and give satisfactory yield. The onion crop is no exception to this rule, and in order that we may understand the requirements of the crop as to soil and fertilizers, it is important to consider the characteristics of the plant. The onion is an enlarged stem. Its root system is small in extent, fibrous in character, and unusually shallow in distribution. It is particularly sensitive to unfavorable soil conditions, which develop a strong and undesirable quality.

Plants in general use for the production of their stems and leaves nitgrogen and potash in much larger quantities than phosphoric acid, while those which produce seed make a

heavy draft upon the phosphorus. Chemical analyses indicate that 500 bushels of onions contain approximately 60 pounds of nitrogen, 30 pounds of phosphorus, and 75 pounds of potash.

Muck soil is a special or abnormal soil as compared with the average upland soil. It is formed from the accumulated remains of plants which have undergone decay to a greater or less extent. The primary condition for the growth and accumulation of this material is defective drainage. Such land is naturally saturated with water and the presence of this water has reduced decay processes. Depending upon the extent to which decay has taken place, these deposits may be divided into several classes, which differ very decidedly in their agricultural value.

The first stage from the fresh material and where the substance is coarse, fibrous and usually of a light-brown color, is known as the peat stage. It has such a poor relation to moisture that it is generally unproductive, especially for delicate crops. When the decay has reached a more advanced stage, so that the materials take on a black or very dark-brown color, and become pulverized finely, the remains are known as muck. This is coincident with the increase of the soluble or humus substances, which form a brown liquid which may often be seen leaching from swampy lands. It is the muck stage of such lands which is agriculturally valuable, because this material has a much more satisfactory relation to moisture. It will take up large quantities, ranging from 80 or 90 per cent to 200 or 300 per cent, according to the proportion of humus present. The substance humus should not be thought of as a definite compound. Rather it is a very complex mixture of organic products of decay. It frequently happens that the surface layer of soil is a good quality of muck, but that the subsoil is peaty and to the extent that these conditions exist the value of the soil for intensive tillage purposes is reduced. Such land differs from the upland soil in that under proper conditions the peat will decay and change to muck.

The general character of organic swamp land is generally indicated by the type of native vegetation. Land which bears little or no vegetation, or only that of a shrubby, stunted character, can not be expected to be productive for a good many years after cultivation. On the other hand, if a heavy growth of trees and herbaceous plants is produced, this is very good evidence that the land is capable of producing tilled crops. The best kind of timber is a thrifty growth of elm, black

ash and soft maple. Land which bears almost exclusively cedar has generally been considered as of very inferior productive capacity. However, a few cedars and an occasional tamarack seems not to indicate any unproductive quality if it is associated with the other species. Whatever the character of the land, it is generally best to farm it to the more gross-feeding crops like potatoes, hay or corn for the first one to four or five years, until it becomes settled and active decay processes have been set up. By many growers, potatoes are considered to be the best preparatory crop for onions, which should not be put on to the land until one is assured that its moisture relations are good.

In the matter of water supply, muck areas may be divided into two classes: First, those frequently known as sheet muck, where material spreads over large areas and is relatively shallow, ranging from two to four or five feet in depth on the average. These usually have been formed during a previous lake condition of the area and after clearing they are likely to have a deficient moisture supply, during the late summer, and thereby to greatly reduce crop yields. The other class of muck lands generally occur in small areas, are relatively deep and are likely to have their water-table maintained by springs around the margin of the area or in its interior. Such areas are to that extent insured against any lack of water, even though drained for all ordinary operations. Muck of the usual type generally has a low capilliary capacity, and, therefore, should not be drained excessively. The water-table should not be lowered more than is necessary to permit cultivation reasonably early in the spring. This generally means lowering the water-table to a depth of about 20 inches, varying somewhat with the character of the soil. Open ditches are the best medium for first drainage operations. They may be cut considerably lower than the water-table is to be maintained so that the flood water will be quickly removed, but it is a good plan to insert some sort of a check in the course of the ditch when the water-table has been sufficiently lowered to hold it to that level.

Areas which have not a natural water supply will generally justify irrigation if they are devoted to truck crops. One of the great factors in cutting down yields of truck crops on many areas of muck soil is deficient water supply. When muck dries out, it shrinks excessively and large checks are formed. If these are not kept filled by pulverized muck, by frequent tillage, the loss of water will go on to considerable depths. The dry muck is a very effective mulch so that this

condition can be readily controlled. These facts have a special relation to the tillage of the onion crop, which, owing to its limited root system, is very quickly subject to a deficient moisture supply in the surface foot.

Composition of Muck Soil.

Muck soils are made up chiefly of organic material. They are characterized by being very rich in nitrogen, moderately well supplied with phosphoric acid and relatively low in potash. The following analyses of a number of areas in the state are sufficiently representative:

	Organic Matter	Nitrogen	Phosphoric Acid	Potash	Calcium Oxide
Redwood	88.7	2.42	.27	.15	6.2
Red Creek	88.5	2.6	.26	.18	4.2
Oak Orchard............	65.5	1.8	.28	.26	4.4
Florida	...	2.2	.32	.36	2.6
South Lima, Virgin......	83.4	2.4	1.9	.09	6.3
South Lima, Cultivated..	82.5	2.4	.48	.44	5.9

It will be readily recognized that muck soil requires fertilization with potash, and this practice has been very generally followed. The presence of large quantities of nitrogen, would suggest that nitrogen fertilizers may not be beneficial. But in practice, it has frequently been found that a small amount of nitrogen, especially in the early stages of tillage, is helpful. This is due to the fact that the nitrogen, while large in amount, occurs in rather inert confinations, which requires some time to be made available, but with good drainage and thorough tillage, this process gradually increases in activity and it may frequently be increased by light dressings of well-rotted stable manure. Four or five tons are sufficient. Phosphoric acid, while not especially low in percentage, seems frequently to improve the crop yields. The New York mucks in common with those of adjacent regions in Canada, seem to be very rich in lime, and it is questionable whether lime is needed in this region.

The Department of Soil Technology carried on investigation with fertilizers in the Florida swamp at Breeze Hill, Orange County, for three years. The average yields of onions for three years on the different plots were as follows:

		Yields.
1—Check		11,000 lbs.
2—Sul. of pot.	600 lbs.	19,918 "
3—Acid phos.	1,000 "	19,086 "
4—Nit. of soda	500 "	18,201 "
5—Check		17,612 "
6—Sul. of pot.	600 "	
Acid phos.	1,000 "	26,317 "
7—Sul. of pot.	600 "	
Nit. of soda	1,000 "	21,131 "
8—Acid phos.	600 "	
Nit. of soda	1,000 "	19,056 "
9—Check		13,207 "
10—Check		14,302 "
11—Sul. of pot.	200 "	
Acid phos.	500 "	
Nit. of soda	500 "	22,371 "
12—Sul. of pot.	800 "	
Acid phos.	500 "	
Nit. of soda	500 "	24,517 "
13—Sul. of pot.	200 "	
Acid phos.	1,500 "	
Nit. of soda	500 "	24,852 "
14—Check		19,824 "
15—Sul. of pot.	1,200 "	
16—Raw gd. rock phosphate	1,000 "	16,211 "
17—Raw gd. rock phosphate	2,000 "	14,435 "
18—Check		15,818 "

Across the fertilizer treatments lime and manure were distributed on part of the plots. The average result of this cross treatment was as follows:

A—Check	15,100
B—Lime, 1,500 lbs. CaO	16,900
C—Manure, 8 tons per A	19,300

It will be observed that the largest yields were identified with the complete fertilizer rich in phosphorus and medium in nitrogen and potash; also from the plot receiving a double application of potash. Nitrogen has given very little increase on this land. Phosphoric acid and potash appear to be the elements which produce the crop. It was very evident each season that the phosphoric acid promoted early maturity. Nitrogen seemed to prolong the development of the plants so that often there was a larger proportion of seconds due to immaturity at the time they were caught by frost. Probably the

best policy would include the use of two or three per cent of nitrogen for the first few years, that fresh muck is cultivated. The character of the product should be carefully watched for any indication that it is being excessively supplied with nitrogen through the decay of the soil, and when this condition is observed, the supply of nitrogen should be reduced or eliminated. The quantity of fertilizer to be used on muck soil for onions is large, and probably applications of a ton or more will be thoroughly justified. Lime is of uncertain value, but the effect of manure is clearly evident.

One of the most important practical phases of the management of muck soil is the maintenance of a proper water supply. This requires, first, thorough drainage, and it is believed that tile may often be substituted for open ditches which are objectionable in many ways. Second, there must be thorough surface tillage. Third, on those areas which do not have a natural underground water supply, irrigation should be practiced.

LABORATORY TESTS OF A WET CARBONIZING PROCESS.

Made by Messrs. Wm. B. Ruggles and G. Herbert Condict.

The testing equipment used in these tests consisted of a piece of four inch pipe, nineteen and a half inches long, with a permanent cap, having a steam gauge attached, at one end and a removable cap at the other end. This pipe was placed in a brick oven and heated by a bank of gasolene torches. After the pipe was heated it was removed from the oven and cooled by a water spray. A hydraulic press was used for dewatering.

In the first test the peat had an initial moisture content of 82.1 per cent. Cold pressed for four minutes, to 50 pounds per square inch, this moisture was reduced to 76.5 per cent. After heating in the pipe to 200 pounds per square inch, temperature 388 degrees F., the pipe was cooled and peat pressed for four minutes, at 50 pounds per square inch, to 72.2 per cent moisture content.

In the second test the initial moisture was 83.8 degrees. This was cold pressed to 55 pounds for three minutes and showed 75.1 per cent. A portion was then heated, to 395.6 degrees at 220 pounds pressure. Part of the flame was cut off and heating continued for fifteen minutes, when the pressure had dropped to 160 pounds. After cooling, this charge

was pressed to 55 pounds for three minutes and the moisture reduced to 72.1 degrees. A portion of this last was pressed a second time for 1 1-2 minutes at 800 pounds and moisture reduced to 64.0 per cent.

In the third test the initial moisture was 86.0 per cent. This was reduced by cold pressing at 74.5 pounds to 72.8 per cent and at 820 pounds to 67.6 per cent. A core of wood, two inches diameter, was placed inside of pipe, so as to allow one inch of material between core and pipe. The pipe was heated for forty-five minutes, when it showed pressure of 200 pounds. The pipe was then turned six times, through sixty degrees at a time, and heated at 200 pounds for five minutes at each turn. After pressing at 74.5 pounds for forty-five seconds, the peat analyzed 66.1 per cent moisture and at 820 pounds 57.4 per cent moisture.

Before making each of the above tests, the peat, after thorough maceration, was separated into two portions, one to be cold pressed and the other pressed after heating, so that in each test the original moisture content of both portions would be the same. In all the tests the pipe was entirely filled with peat before placing it in the oven.

The results obtained may be seen in the tables given below and conclusions drawn as to their practical application.

First Test.

	Per Cent.
Initial moisture content of peat	82.1
Pressed cold at 50 pounds per square inch	76.5
Pressed after heating 50 pounds per square inch	72.2

Second Test.

Initial moisture	83.8
Pressed cold at 55 pounds	75.1
Pressed after heating at 55 pounds	72.1
Same portion, pressed second time at 800 pounds	64.0

Third Test.

Initial moisture	86.0
Pressed cold at 74.5 pounds	72.8
Pressed cold at 820 pounds	67.6
Pressed after heating at 74.5 pounds	66.1
Pressed after heating at 820 pounds	57.4

THE TULE LANDS OF CALIFORNIA.

Dr. Charles B. Lipman, Soil Chemist and Bacteriologist, University of California College of Agriculture, Berkeley, Cal

The swamp and muck lands of California are largely those which are classed under the head of "tule" lands and it is well to retain the name of "tule" lands, because there is an important distinction between the nature of tule material in such lands and the true peat material. The organic material of tule soils is in only partly decayed condition, and a great deal of the surface material, especially, is of recent formation from the deposition of fallen tule plants. It is always more fluffy and loose in its nature than the peat material and decays more rapidly when air is admitted than the latter, besides showing many characteristics when crops are grown on it which are entirely different from those of the peat under similar conditions. Notable among these characteristics is the ability to produce crops without the addition of lime, in most cases, and actual tests on many of our tule soils fail to show any acidity. Unlike the peat soils of the East, also, the tule soils rarely show a marked deficiency in potash. The drainage of such tule lands and some similar areas of the true peat land and muck in this State have gone on, on a rather large scale thus far. It is estimated by drainage engineers, who are connected with the projects referred to, that about 400,000 acres of swamp lands, including tule and peat, which border on the Sacramento River and are also comprised in the delta lands at the mouth of the San Joaquin and Sacramento Rivers where these converge, have been, or soon will be, reclaimed by drainage for crop growing. Much of such reclaimed land is already producing profitable crops today. In addition to the 400,000 acres along the banks of the Sacramento River, and at the mouth of the Sacramento and San Joaquin Rivers, there are about 60,000 acres being reclaimed by the Natomas Consolidated Company of California. This land is situated in the drainage area of the Bear River, and includes a large proportion of tule land, though some of it is merely overflowed silty clay land. This will all be reclaimed and used for crops very soon.

The crops which have thus far given the best returns on tule lands and such peats as have been reclaimed in small acreages are potatoes, grains, celery, and some of the leguminous forage crops, which are used for soiling purposes. The latter have been grown only in small acreages and particularly in connection with some of the dairy enterprises on tule islands.

Grain and potatoes have been particularly successful on these lands and give profitable yields. Recent experiments of this Experiment Station, carried out by the Division of Agronomy, indicate further that certain treatment of tule lands can also be instrumental in increasing the crop very considerably. Such treatment it would seem, would largely consist in lime applications. The serious fact is, in this connection, that soils which do not show the acid reaction are distinctly benefited by the application of lime. It has also been observed in these same experiments that, while the grain did not show any extraordinary appearances as it stood in the field, the crop was larger and of better quality when harvested.

Peat has not been used for fertilizer purposes in this State, so far as I am aware, though I have no doubt that perhaps in very small quantities and in a few individual cases, some of it has been employed for that purpose. However, its use in that direction has certainly not been large enough to warrant particular mention now.

With reference to experiments on the use of peat for fuel power, gas, and stable bedding, I have the following to say. Mr. Mark L. Requa, who is one of our authorities on the subject of the employment of materials used or which can be used for fuel or other purposes, above mentioned, has recently made a report to the Commonwealth Club, as part of a general conservation report, made by their Conservation Section. In this he states that despite the fact that a considerable quantity of peat is to be found underlying a limited section of our tule lands, little or no attempt has been made, either experimentally, or in practice, to utilize such peat deposits. He states that most of the peat material is to be found underlying the tule areas, which I have mentioned above, at considerable depths, and also that there are shallow peat beds of not nearly so much value, to be found beneath the Sutter and Yolo basins, beneath the marshes fringing the San Francisco Bay, beneath the lands near the mouth of the Salinas River, and beneath the land of that portion of Klamath Lake which is situated in California. He states, however, also, that these latter areas do not begin to compare in possibilities with the area of peat lying under certain small portions of the tule lands of the Sacramento and San Joaquin Rivers. He estimates approximately that there would be about 60,000 acres in California which it would pay to work for peat and that these would yield, as proven by test, certainly 72,000,000 tons of peat and it has been estimated that possibly 1,188,932,800 tons might be obtained from these deposits in various portions of the State.

However, as above stated, no use has been made of these deposits and but little attempt in fact has been made to develop the industry. Mr. Requa points out that even if the peat deposits here should be developed, they cannot compete with California oil so long as that is produced as a source of fuel. He says further that it is believed by authorities on the subject that by the time peat becomes a commercial possibility, "hydro-electric power will be sold at prices which will render its production unprofitable." (For further information on Mr. Requa's report, see Volume 7, No. 2, of the Transactions of the Commonwealth Club, entitled, "Conservation.")

These brief statements bring out the salient points with reference to the status of the peat question in California.

THE UTILIZATION OF PEAT.

By F. M. Perkin, Ph. D., F. I. C., F. C. C.

(From "The Chemical Trade Journal and Chemical Engineer," London.)

Owing to the enormous areas of peat bog which are found in various parts of the world, and to their comparative uselessness for agricultural purposes, attempts are constantly being made to work the peat up into something commercially valuable.

The use of air-dried peat sods for fuel purposes has been practised for hundreds of years, and in places where coal is expensive or difficult to obtain, such as in the Highlands of Scotland and in Ireland, peat is still largely used as a fuel. The peat is simply cut and stacked, and is not treated in any way. These peat turves are, therefore, porous, and for a given weight occupy a very large volume. There are, however, many places in Europe where the peat, after it has been dug, is pulped so as to destroy the fibre, and is then made into briquettes. While the fibre remains in the peat it is not an easy matter to reduce the moisture in it to any great extent, but after pulping and converting into briquettes, it can be dried more rapidly and completely, and forms dense hard blocks. In fact, if the peat is of good quality and has been well pulped, the dried briquettes are so dense that they can easily be turned on the lathe, and closely resemble Irish bog oak. Generally speaking, the briquettes contain from 18 to 25 per cent. of moisture.

These peat briquettes make an excellent fuel, burning with very little flame and giving out a good heat. Although the calorfic value is lower than coal, yet steam can be raised more rapidly by using peat briquettes than when coal is employed.

Of course a great deal depends on the source of the peat; some peats have a very high percentage of ash, and therefore are unsatisfactory as a fuel. A good peat, such as can be obtained in some Scotch or Irish bogs, does not contain more than 1 to 1.5 per cent. of ash, calculated upon the anhydrous material. An important point about the ash is that it shall not be readily fusible, as with some classes of peat considerable trouble has been caused by clogging of the fire bars, due to the low fusibility and high percentage of the ash.

On the average, compared with coal, 1.8 tons of air-dried peat containing about 25 per cent. of moisture are equivalent to one ton of coal, but with a good briquetted peat containing 18 to 20 per cent. of moisture the ratio is about 1.5 to 1.0. Briquetted peat can be produced at from four to five shillings a ton, therefore 1½ tons, taking the latter figure, will cost 7s. 6d. The answer to the question whether this can compete with coal, say at twelve shillings a ton at the pit's mouth, will depend upon the relative case of transport and the prevailing rates. Supposing the cost of transport per ton of the coal to be 5s. to a given point, and the same rate to apply to the peat, then the transport for the same equivalent of peat will be 7s. 6d. The ton of coal will cost 17s. delivered and the 1½ tons of peat 15s. delivered. As a matter of fact, however, peat briquettes occupy more space per ton than coal, consequently the 2s. 6d. margin here shown would be wholly or partially wiped off. For manufacturers who have boilers near to the source, peat fuel could be economically employed. Experiments have recently been tried near Glasgow. Peat briquettes were employed on a Caledonian Railway engine and on a colliery shunting engine. The equivalent to coal was about 1.25 tons peat equal to 1 ton coal. With the ordinary grate it was difficult to use forced draft. Mixed peat and coal briquettes, however, were very satisfactory, even with forced draught.

Supposing, however, that peat fuel were rather more expensive than coal, it has certain advantages. It is cleanly to handle, burns brightly and clearly, gives out a good heat, and produces practically no smoke. In this connection it might be mentioned that condensed peat fuel is largely used in Holland, notwithstanding that it costs more than coal, or at any rate did a few years ago. It has been found in experiments carried out on a boiler in a sugar factory in Sweden, that by mixing coal with peat in the ratio of 1 : 1 the heating value of the peat fuel increased by 14 to 18 per cent. As coal seems rather to be going up than dropping in price the question of peat as a fuel is well worth consideration, particularly for domestic purposes.

Although peat might be employed as a fuel it can be much more profitably utilized for charcoal and by-products.

When well-briquetted peat is subjected to dry distillation an excellent and dense charcoal is produced. The quality of the charcoal naturally depends upon the quality of the peat and also upon the method employed in the distillation process. Charcoal produced from a good peat which has been well briquetted is extremely dense and hard, and is therefore very valuable for metallurgical purposes, as it will bear a good overburden without crumbling. The specific gravity of the charcoal varies between certain limits, depending upon the character of the peat and the manner in which it has been briquetted. Different samples examined by the writer have varied between 1.36 and 1.75.

As a necessary corollary in the manufacture of peat-charcoal large quantities of by-products are obtainable. These may be briefly described as follows:—(1) Gas of high calorific value. (2) Ammonia. (3) Aqueous liquor. (4) Tar.

The amount of gas which is given off is sufficient, after the retort has become thoroughly heated, to fire the retorts and carry on the whole of the distillation. Even then there is a considerable surplus which can be used for gas engines, firing boilers, or for other purposes. The high calorific value of the gas is due to the large proportions of hydrogen, methane, and carbon monoxide. The actual composition of the gas varies according to the temperatures of carbonization and other details.

The amount of ammonia produced naturally depends upon the nature of the peat—i. e., the quantity of nitrogen it contains. It also depends upon the manner of carbonization. On the average, the amount of ammonia obtained compares very favorably with that obtained in coal-gas practice The bulk of the ammonia is contained in the aqueous liquor, from which it can be obtained by the usual methods, the rest being obtained by scrubbing the gases. The aqueous liquor, however, also contains methylic alcohol and acetic acid, and at times varying quantities of acetone, which, of course, are valuable products.

The tar on treatment and distillation yields light and heavy oils and paraffin wax, also phenolic bodies, amongst which the author has found guiacol. There are also small quantities of bases.

From 100 tons of peat containing about 20 per cent. of moisture 1½ tons of sulphate of ammonia are obtained, four to five cwt. of acetate of lime, and 50 to 70 gallons of methyl al-

cohol. The quantity of crude oils is about two tons, and of creosote oils about 1½ tons. The coke varies from 30 to 34 tons. All the products are readily saleable.

As has already been pointed out, the original peat, if used for coking, must be of good quality, when it contains over 2.00 per cent. of nitrogen, and provided this nitrogen can be obtained as sulphate of ammonia, then the by-products alone should be sufficient to pay all expenses and leave the sale of the coke as all profit. There are, however, many initial difficulties to be overcome. The pulping and briquetting must be economically yet satisfactorily carried out. The methods of drying are of the utmost importance. The scrubbing of the gas and the elimination of the tar present considerable difficulties, while the design of the retort and temperature of coking have a great bearing on the quality of the products.

Another process of peat utilization must be referred to in its employment for power gas purposes. In this connection it is claimed by the Power Gas Corporation that the sales of ammonia sulphate will alone pay for the cost, upkeep, and working of the plant, and afford a good dividend.

A most interesting report on the utilization of peat fuel for the production of power has just been issued by the Department of Mines of Canada, in which it is shown that peat fuel can, when used in this way, compete satisfactorily with other fuels.

If peat is to be used for power purposes, then it is a sine qua non that the bogs should not be far from some industrial center, where the power gas can be readily disposed of.

Other methods of working up peat, such as manufacturing paper, alcohol, artificial wood, etc., are not much beyond the experimental stage, but when it is considered that in Scotland alone there are something like 250,000 acres of peat bog land, the question of peat utilization is obviously a most interesting proposition.

A Demand for Peat Fuel. A firm in New England is in the market for peat fuel and there is no one known in the region who can furnish the quantity needed. The peat must be of good quality, ready to use, and must be delivered at the rate of about two carloads, about 50 to 60 tons, per week during several months. There is a chance for some of our New England Peaters to win distinction for themselves and make and sell the first really large quantity of peat fuel produced in the United States. Who is ready to supply this demand? Any one who will really undertake the contract, will please address the Editor.

VALUE OF POTASH FOR CABBAGE ON MUCKY SOILS.

J. F. Mojta.

At the Menominee County School of Agriculture, there are annually a number of demonstrations in progress and one with cabbage on muck soils gave some interesting results.

The purpose of this trial was to find out what effect an application of sulphate of potash would have on the quality and growth of cabbage in mucky soils. The field selected for this work was low with only a fair drainage. There was about six inches of mucky surface soil, underlaid with a white sandy subsoil. A large crop of oats was harvested from this field the previous year and it was plowed in the spring of the year at a time when the cabbage was planted.

The trials were made on two one-tenth acre plats. One was used as a check and to this no fertilizer was applied. To plat 2, twenty pounds of sulphate of potash was applied broadcast and it was harrowed with a spike tooth harrow. About a week later, and on May 15th, Flat Dutch cabbage plants were planted three feet apart each way. The plants were about five inches high when taken from the hotbed.

It rained considerably during the summer and several times during the growing season, the plants suffered from too much water in the soil. However, the plats were cultivated three times during the growing season. It was quite noticeable that where the potash was applied there was a much better growth of healthy looking heads of cabbage. On Nov. 7, the cabbage crop was harvested from each plat separately with the following results:

Plat 1.—Check, no fertilizer, 1-10 acre 1,376 pounds—one acre 13,760 pounds.

Plat 2.—20 lbs. Sulphate of potash, 1-10 acre 2,254 pounds, —one acre 22,544 pounds.

Figuring the cabbage at $3 per ton and the fertilizer, sulphate of potash, at $3.25 * for 100 pounds, the value of the cabbage crop and the cost of the fertilizer, on the basis of an acre is as follows:

Per Acre.

Plat 1:—6.88 tons at $3.—$20.64.

Plat 2:—11.272 tons at $3.—$33.816, a gain of $13.17, cost of fertilizer $6.50.

*The cost of potash is rather high because of the high local freight rate from Chicago to Menominee. If potash were shipped direct from Baltimore to Menominee in car lots the cost would not exceed $50.00-$55.00 per ton.

It will be observed that there is a material increase in the quantity of cabbage in Plat 2, to which sulphate of potash was applied, and there is a net gain of $6.67 per acre over and above the cost of the fertilizer. It is evident that most mucky soils and those containing considerable humus are possessed of some nitrogen but are very much in need of the potash fertilizer to supply the mineral food necessary for healthy vigorous growth.

PEAT FUEL.

Electrical Review (London), Apr. 19, 1912.

The discussion of Mr. Tomlinson's paper in Dublin was of high value. In the first place, the speakers kept strictly to the subject, which cannot be said of discussions in general, and secondly, all those who spoke for other than complimentary purposes seemed to have read the paper carefully beforehand—a precaution which has so much to recommend it that its constant omission is a matter for wonder.

The audience obtained much assistance from the admirable speeches of Messrs. Carter and Turnbull, representing respectively Messrs. Crossley Bros. and the Power Gas Corporation, the two firms which have done most to advance the practical use of peat upon economical lines. The representatives of both firms are to be congratulated upon the strictly legitimate use of a very tempting opportunity for advertisement and odious comparisons.

We believe that a syndicate has spent a large sum of money upon experiments on a bog in Dumfries, which involved the use of a good deal of machinery, but nothing was said of the results at this meeting, so it would not be surprising to hear that in this case, as in so many others the bog has won again. If that should be so, Mr. Tomlinson's theory will receive further support, and it might pay these experimenters even now to try it.

The record of the old Dutchmen's work may be said to have given birth to this theory that Nature, aided slightly by man, will give us peat in large quantities dry enough to use in gas-producers; and it was from modern Dutchmen's industry that Mr. Carter drew the most helpful facts. In spite of severe competition with cheap Welsh anthracite, and cheaper Belgian semi-bituminous coal, peat is a commercial product in Holland to-day, and that is due to the simple methods of getting it. Moreover, experience has proved that there is an

almost negligible difference between the results obtained from peat with 34 per cent., and 62 per cent. water, while the gas is as good as that from the best Welsh anthracite. In fact, peat is an almost ideal fuel for use in a producer, for it does not clinker, and leaves but little ash, and the grate is kept clean. A centrifugal extractor deals with the tarry matter satisfactorily.

Critics of the theory of drying peat in situ may ask, with a show of reason, what is to prevent the winter's rain undoing all the work of the summer's sun, even though the mass be drained in the manner proposed, in which event the peat harvest would be confined, as at present, to the short summer months; but the Dutch have proved that a stack of peat will emerge from winter with only 40 per cent., or thereabout, of water, and any Irish or Scotch peasant, whose only fuel is peat, will point to his stacks in evidence of the fact that summer-dried peat, which has not been protected from excessively humid winter weather, does not take much more water.

We have advanced much nearer the utilization of peat upon a very large scale than most people imagine, and the sooner the professional men who have an intimate knowledge, of the facts, start in to educate the laymen who have the opportunity and the means to turn the bogs into gold and smiling pastures, the better it will be for the country at large.

We know now that peat is an ideal fuel, and that engines of any size can be run with the gas it gives off. We know that the products of peat, other than fuel gas, are as valuable as the products of anthracite, and the method of getting them is an old story. What we do not know is the simplest part of the whole affair; it is the way to get peat into the producer at a cost which will allow a profit to be made out of the sale of the peat products—chemicals and power. That is what we do not know, say for Ireland or Scotland, out of practical experience upon a sufficient scale; but now we are able to guess it more nearly by the light of the fire which Mr. Tomlinson has struck out of the 18th century Dutchmen and Mr. McMeadows.

Mr. Turnbull says that his company has solved even the last problem, as instanced by the important peat recovery and power plants at Osnabruck (Hanover)and Orentano (Italy), and there is no reason to suppose that these installations are not quite satisfactory; but they cannot be taken, and Mr. Turnbull did not suggest that they should be taken, as sure guides to success in the Irish bogs.

But what a little thing it is that stands between Ireland and fortune—£10,000 ($50,000) spread over five years to prove

whether or not a bog can be made to contain only 50 per cent of water by drainage and evaporation.

Not Ireland only stands to win heavily with any stake that is thrown, for England and Scotland possess large peat deposits in parts remote from coal, and the nation is waking up to the belief that the world was not made for the coal miner alone. The price of coal will stay at higher rates than before the strike until the owners and the distributors have recouped themselves for their enormous losses from the pockets of the consumers, and after that the rates will be as much higher than the previous normal as the wages bill is above the old wages bill. Therefore we shall all keep our eyes turned to the quarters from which relief may be expected, and the peat-fuel problem ought to get such a chance of solution as it has never had before.

Mr. Tomlinson's investigations and the discussion of his last paper, have cleared a broad straight road to success; but let us be quite sure that we have all got out of the jungle of previous failures to the point from which we can see that road clearly. The engine is ready, the producer is ready, and the recovery plant is ready. The peat is waiting in untold quantity to be put into the producer at a price which will allow a net profit to be made upon the manufacturing process which are to follow, and money will pour in directly the peat is ready at the price. Mr. Tomlinson says that this price is to be not more than 4s. He may be right, or he may be wrong, and nobody can say until what we called the grand experiment has been made. If 4s. is not exceeded the bog can be worked at a profit for sulphate of ammonia alone and it is that fact which gives us so much more hope for peat than ever before, and leads us to lay down the following sequence of events for the guidance of those who would see clearly down the broad road.

First, then, comes the drainage of a selected bog—say the Bog of Allen. When this is proved feasible, but not a moment earlier, is to be put down a recovery plant upon a large scale.

When this is working at a profit, but not a moment earlier, may be put down the generating station, upon as large a scale as the probable demand requires; and, as the date of completion of this station might be 5 or even 10 years after the first drain was cut, there would be ample time in which to canvass for consumers of electricity.

A scheme properly thought out on those lines will be much more likely to command success than the scheme to which we are so unhappily accustomed, involving usually the immediate expenditure of huge sums upon machinery and plant for cutting

and drying the peat, for gasifying it and producing electricity, and for transmitting the electricity over large areas of desolate country in search of consumers.

PEAT ABOUT BOSTON.

Boston Transcript, Sept. 21, 1912.

This month people begin talking about the rise in coal, but former State geologists have said there is peat enough in eastern Massachusetts to supply fuel for all the manufactories and households for a century, without one ton of coal. Evidently it is a strain on the Boston mind to believe that you can go out to Hyde Park, say, and dig peat with a trowel, fifty feet from the trolley line, fetch it home in a newspaper, dry it on the extension roof for a fortnight and set it blazing in the range or the parlor grate.

The truth is that a large and lovely mine of wealth exists within a ten-cent fare of the State House, beginning at Pauls Bridge at the foot of Blue Hill, lying under Readville race-track, up where Purgatory Brook has held its way and its bad name for two hundred years, skirting Norwood, to Canton and Sharon, a long inlet of level green, a river of grass between low banks, tranquil, lonely and silent, a field of bliss for those who love silence and sweet air, and large green wildernesses. It is not plushy growth like the Lynn marshes or the New Jersey coast, but a stretch of low grass and flowers, which grow on the bog with a richness of color, height and perfection nowhere found off it. Little low families of trees and bushes cluster in islets on this grassy stream, which carries so much wealth under the roots of its meadow plants. Follow Neponset Street a mile from the trolley, along the quietest of country roads, past the greenhouses and the flowercrops of well-to-do florists and farmers, a comfortable, restful Yankee neighborhood, with not a pretence of a colonial mansion or a pergola all the way, and only one motor passing in the afternoon. After a leisurely walk of a mile, there appears on the bog, at foot of the sloping meadow banks, a small wooden factory gone to decay. Various shelters and drying platforms are left of what was ten years ago an ambitious attempt to work the bog for financial success. Barrels of specimen briquettes were made, enough to show in State street offices and in New York, very high names in business were quoted as managers and stockholders, civil engineers of repute were coming and going over the bog, while an enhancing secrecy and mystery were preserved about the working of the small factory on its edge.

Read by the light of later experience, it is plain that just enough briquettes were made to supply samples for State street and Hartford offices, with which a valiant effort was made to sell, not peat fuel, but peat stock. The briquettes burned beautifully in the office grates, where the stock was held, but you never could buy a barrel or a bushel to burn in your own house and people who were hoping for a cheap fuel were told of high-class hotel keepers who stood ready to order the pressed peat at $12 a ton, to burn in select guest chambers. It came round years after that the eminent civil and mining engineers who were consulted declared the peat along Purgatory Brook was first rate, and plenty of it, but it was a manufacture for the future.

Today the strain is to save every farthing possible on fires, whether of coal, gas or kerosene stove. This bog which begins with Purgatory Brook contains 3,500 acres of the finest fuel in nature, and this bed of peat runs from four feet deep at the borders to thirty feet in the middle, over which farmers cut hay and drive loaded wagons. And there are few townships in eastern Massachusetts which have not enough of such peat beds to serve their people for generations. Peat is a democratic fuel, and it is easier to cut it out of the bog and dry it than to cut trees from your own wood lot, season and split the wood. A good peat bed cuts like cheese and works enough easier than trenching garden beds. A man's work digging peat averages ten tons a day of the wet stuff. Then all that is necessary to fit it for firing is to dry it on the bank for three weeks or six, according to weather, turning it one or more times in the process, and piling it V-shaped to let the air through freely.

The dry peat wants less kindling than a wood fire. A coal grate is the better for a piece of thick wire netting laid inside the bars, to keep the turf from falling through, just as it is needed when you undertake to have a little wood fire, early autumn evenings. Set two pieces of peat together, tent shape, with a few pine bits under it, and it burns like wood dipped in kerosene, only it doesn't go out so soon. Miss Mann, for a generation town librarian in Dedham, used to tell how good families in her girlhood always laid in moss peat for invalids' and old folks' fires, because it kept such steady, mellow heat all night long. The good houses in England pile peat turves, not the briquettes, with the beech and oak billets and logs in the splendid old carved fireplaces of stately drawing rooms, because the peat makes a softer, more lasting heat than wood or coal. And one hears of the richest folk in New York or indeed in all American society, who import their peat by shipload from the other side to burn in Fifth avenue chateaus.

Peat, burning, sends an aroma like campfires through the house. Hence the common peat is the fuel for studio fires and household grates, with people who know things. Up in Vermont, when a farmer wants money, he takes a load of dry peat to the next market town and sells it offhand, to housekeepers and the stray artists and author folk who linger in the hill towns till December. One and four-fifths of a ton of dry peat is estimated to equal a ton of coal for heat, with this difference, that one-fifth to one-third of a ton is ash and cinders, which waste so much heating power, while good peat does not allow a single clinker from an evening's fire.

Four years ago the abandoned works on this same Purgatory bog were set going by a firm of father and son, who made briquettes and sold them by wagon up and down, from Norwood to Hyde Park, at a cost of less than $5 a ton, people wanting more and ever more of them for house use. Then one of the steam boilers exploded and the business was abandoned again. Still there is the bog with millions of tons of blessed fuel under its herbage, and, incidentally, millions of money for those who send the firing to those who sorely want and need it.

POSSIBILITIES OF PEAT DEPOSITS.

The Christian Science Monitor of Boston, Mass., under date of Nov. 8th, 1912, prints an interesting and intelligent article on "How Peat Riches of America Can Be Utilized as Cheap Fuel." We extract here some of the more interesting parts.

The most frequently occuring peat bog builders are found among mosses and plants, of which the following genera are the main representatives: Sphagnum, Hypnum, Polytrichum, Eriophorum, Carex (sedge), Vaccinium family (blueberry), Iris, etc

Every peat bog is composed of a variety of these and other vegetable forms, herbaceous plants, trees and masses; and being a complete unit in itself, the bog becomes a product of climatic conditions and dependent upon the climatic infiuences.

Peat bogs vary greatly in age, though those occurring on the North American continent belong to that prehistoric period which followed immediately the glacial period. Occasionally bogs are found underlying clay and boulders, which indicate that their origin is to be found in the interglacial or preglacial period. Where such bogs occur in the immediate vicinity of the sea, as in Maine and the maritime provinces, it is evident that either the sea has risen to a higher level since the glacial period, or else the level of the dry land is in a state of sinking, as no

acquatic plants "grow into bogs" under the influence of salt water.

The climatic conditions of the hemisphere north of the tropic of Cancer are extremely favorable for the growth of peat bogs and thus we find immense areas in all countries of northern Europe, (Sweden, Finland, Russia, Germany, Austria, Hungary, Denmark, Holland, Ireland, etc.), as well as on this continent in the United States, Canada, the maritime provinces and Newfoundland.

Naturally it is in these countries, lacking a good and at the same time cheap fuel, that the peat industry has become a commercial factor of great significance. Thus we find peat put to all kinds of uses. In addition to its utilization as fuel and as a good substitute for coal and wood it also leads in other services to which it may be put. It makes an excellent stable litter and bedding material, owing to its softness and its capacity to absorb moisture to a very great extent, which reaches frequently eight times its own volume. It is used extensively, especially in the United States, as a fertilizer filler, because of its nitrogenous contents, which are found in the form of ammonia. For this, as well as for the reason of its digestibility it is used as stock food and in charred form as chicken food.

In many places of Europe, peat is successfully used in the gas producer. On this continent there is only one peat gas producer known to be in operation, that of the experiment station of the Canadian government, which is responsible for the statement that the fuel cost per horsepower year does not exceed $2.50, against $7.50 for the same result with coal. Among the many uses to which peat and peat mosses can be put, are: Insulation materials, alcohol production, packing material, paper, textile products, peat-wood bricks for building, paving, etc. Its proper exploitation along these lines is in some instances more advanced than in others. While some of the named industries are practical and feasible, others are impracticable and are, so far at least, commercial failures.

A large number of attempts have been made in almost every civilized country to manufacture peat into fuel, but in most cases these attempts failed either on account of lack of information and practical knowledge on the part of the management, or because of underrated financial requirements. In Europe these failures were not so frequent as on this continent, partly because of the small number of men who, notwithstanding their self-recognized ignorance in peat matters, attempted to establish a private peat industry, and partly because of less credulity on the part of the investing public. How-

ever, the greatest check was put upon so-called "peat promoters" by the respective governments and by semi-scientific peat organizations, of which there exists only one in the United States (the American Peat Society) with a handful of members, while in Germany over 2,000 members unite in their work of raising the peat industry and peat agriculture to a high standard. The significance attributed to these things may be understood from the fact that the German Emperor has become one of the greatest peat enthusiasts of Europe. He developed the once impenetrable marshes of Prussia and Pommerania into places of high and intensive agriculture and into excellent ranches for cattle raising. This is the best proof of what can be done in peat with energy, diligence, proper management of the business, and with money.

By the elimination of numberless more or less plausible and interesting, but from a financial standpoint impossible "paper processes," we arrive at the conclusion that the only commercially profitable way of peat fuel manufacture is basically dependent upon four points: (1) Mechanical excavation, (2) maceration by mechanical means, (3) delivery and spreading of raw material on the drying ground in the immediate vicinity of the excavation, (4) elimination of all manual handling of the raw material until dry.

The peat fuel manufacture on this continent is in its infancy, while Europe has in daily operation several thousand peat machines and manufactures and uses about 15,000,000 to 20,000,000 tons annually. Russia alone makes about 5,000,-000 to 6,000,000 tons per year, and Germany 3,000,000 tons.

CONVERTING PEAT MOORS INTO GAS AND ELECTRICITY.

Consul William Thomas Fee, Bremen, Germany; in response to inquiries from American power and gas companies.

During many years the Prussian Government has endeavored to secure the utilization of the extensive moors in the neighborhood of Bremen, in the Province of Hanover, and large sums of money and great effort have been expended for this purpose. A "Moor experiment station" was located at Bremen, where means and ways were studied, and experiments with the soil of the moors were made to discover a method whereby these extensive waste lands might be brought under cultivation, and induced to yield their proper share of production.

Peat, being a poor man's coal, does not permit heavy shipping charges, and as the consumption of peat produced even in the more easily accessible districts had rather decreased, coal and gas having taken its place in many households, a way had to be found to utilize the peat at its place of production, or in the moor itself.

After several trials this was accomplished by making use of the great sources of power contained in the vast masses of peat, and at the same time improving the soil and making it fit for farming.

Power Plant—Electricity Supplied.

The Government, out of its desire to have the lands cultivated, had dug, at its own expense, drainage canals in the governmental district of Aurich, East Friesia. The transportation of the great quantities of peat, dug out on this occasion, to the larger peat-consuming cities was too expensive, and it had to be disposed of in some other manner. Thereupon the Government erected a power station in a convenient location on the land to be drained, using the peat as fuel. Thus originated the power plant at the Friedeburger Wiesmoor.

Shortly after establishment this plant was sold to the Siemens Elektrische Betriebe, which enlarged it considerably. It now supplies electricity to the cities of Norden, Emden, Aurich, Bant, Wilhelmshaven, and also to a large rural district.

In establishing the gas and electricity plant in the Schweger Moor, Province of Hanover, ideas and methods were carried out similar to those which proved of practical worth in the founding and development of the Friedeburger Wiesmoor plant.

Utilizing the By-Products.

For the purpose, however, of obtaining certain valuable by-products there was followed at the Schwegermoor plant the advice of the experts, Geheimrat Prof. Dr. A. Frank, Charlottenburg, and Dr. N. Caro, Berlin. The peat is gasified, leaving sulphate of ammonium, a valuable fertilizer, and tar as by-products in sufficient quantities to meet the running expenses of the plant. The gas is used as fuel in generating electricity, while the tar serves as fuel under the gas generators.

The indirect way of making use of peat as fuel has one great advantage which must not be underestimated. It is generally known that in order to advantageously use peat as fuel the peat must not contain more than 30 per cent humidity. In this climate of nearly constant dampness it is very difficult to obtain dry peat in such quantities as would be needed for fuel by such a large plant. As peat, for gasification, may contain

up to 70 per cent humidity, it is much easier to supply the plant with the necessary quantity, the more so as under such circumstances peat gathering may be extended until late in the fall. To run the new plant Hannoversche Kolonisations und Moorverwertungs Gesellschaft, a limited stock company, was formed, with headquarters at Osnabrueck. This company purchased the Schweger Moor which covers about 2,471 acres, and is in the Kreise (district of) Wittlage and Bersenbrueck, near the city of Osnabrueck. In the spring of 1910 construction of the plant was begun, and on October 2, 1911, the first electricity was supplied.

Methods of Operation.

The peat which is to be gasified is broken up by a tearing machine and then passes from the bunker into the generator. The gas obtained undergoes a purifying process and is said to be ultimately absolutely pure. The salt obtained by this method is said to be also of good quality. The following will illustrate a good average result of the working at this plant:

During December, 1911, there were gasified 1,325 metric tons (1,000 kilos = 1 metric ton = 2,204.6 pounds) of raw peat, of 60 per cent humidity, being equal to 530 tons of absolutely dry peat. The fuel used in this particular process consisted of 170 tons of raw peat, of the same humidity, equal to 68 tons of dry peat, together with some tar. It may be observed that the use of peat as a fuel has since been discontinued, tar alone being now used in operating the plant.

The above mentioned 530 tons of dry peat produced as a by-product 18.3 tons of salt, or 34.5 kilos, per metric ton of dry peat, containing about 1 per cent nitrogen. This means that about 75 per cent of the nitrogen contained in the peat has been made useful in the form of sulphate of ammonium—a very favorable result.

The above mentioned 530 and 68 tons, equalling 598 tons of dry peat, produced 427,000 kilowatt (hours) power, or 715 kilowatt hours, per metric ton of dry peat, being about the same as 1,000 electric horsepower (for one hour) to the ton of dry peat.

Extensions of an Italian Enterprise.

(Consul Frank Deedmeyer, Leghorn, Italy.)

The question has been asked by an American gas company whether there is in operation at Pontedera a plant for the utilization of peat in the manufacture of electric current, with special provisions for particular recovery of ammonia in the form of sulphate as a by-product, that if this plant is now in operation, when it was built, and its approximate capacity.

There is in operation at Orentano, about 8 miles distant from Pontedera, such a plant. It was built 6 years ago. Its approximate capacity is the developement of 2,000 kilowatts.

In the combustion of the peat used here ammonia in the form of sulphate is gained as a by-product. The plant is of the English system known as the "Mond." The peat used is dug from the bottom of a former lake, once known as the Lake of Bientina.

Improvements and additions are now being made to this plant for the primary object of developing a stronger electric current. It is owned and operated by Societa per L'Utilisazzione dei Combustibili Italiani, and its principal office is in the city of Milan, Italy. When so enlarged electric current will be supplied to the Societa Ligure Toscana di Elettricita to propel street cars and for other industrial purposes.

The Sale of Inferior Peat Products. Nothing will kill the reputation of a new or little known product, or substance, in any market so quickly as selling an inferior grade, or misrepresenting it to the public, either through ignorance, or by wilfully sending out poor goods. This is particularly true of substances like peat fuel which are, at their best, in competition with much better materials and must furnish from the outset in their best possible condition to obtain a foothold in the fuel markets of the country.

Recently there has come to the notice of the officers of this Society a case in which a carload of peat fuel was sold after submission of samples that analyzed only 15 per cent moisture. The purchaser reported that when the carload was delivered and the attempt was made to use it, very little heat could be obtained from the fuel. Samples were taken and analyzed and gave moisture 48 per cent and ash 24 per cent. That is, the alleged fuel contained only 28 per cent of combustible matter. Naturally the purchaser has a feeling that he has a grievance in being supplied with such poor stuff. From the business point of view, it would seem that any one who had a carload of peat fuel to sell would see to it that it was good enough at least to come up to sample and better if possible, so that the customer would want to buy more. The sale of wet peat high in ash, for fuel, or any other purpose, if not according to the sample submitted, will react against not only the seller, but against the product in general and should not be allowed by any chance to go on. Producers should take the greatest care to put only the highest grades of peat fuel on the market, if they hope to make a success.

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EDITORIAL NOTES.

A Long Step in Advance. It is with great satisfaction that the officers announce that an agreement has been made by which the American Peat Society, in co-operation with the Bureau of Plant Industry of the United States Department of Agriculture, will begin, at once, a series of tests under field conditions to determine what crops are best for peat or muck soils, how best to treat crops on such soils, and, in short, to go thoroughly into the agriculture of peat, as it has not before been attempted in this country. The plans for the work and its scope have not yet been fully worked out, but experimental work has already been started and will be carried on during the entire season. It is hoped to make a more extended announcement, and give the details of the agreement in the July number of the Journal. This work cannot fail to greatly benefit the Society and its members, as well as all who own peat or muck land suitable for farming.

A Correction. The attention of the Editor has been called to an evident mis-statement appearing in the December, 1912,

number (vol. 5, No. 4) on page 242. The paragraph in question reads:

"Trials to make use of the Pommeranian peat have recently been made, according to the Ostee Zeitung of Stettin. It was demonstrated that the Goerlitzer suction gas producer showed 5½-6 times better yield in heat units generated than the Mond process."

The note was "clipped" and inserted in this Journal without due consideration of the general indefiniteness of its statement, or of the conclusions that could be drawn from it as it was finally printed. There is, however, evidently a misprint, or an error in translating, which make the figures quoted of no value, as the following brief consideration will show: If it is assumed that the "yield in heat units generated" refers to the number of thermal units per cubic foot of gas generated, the usual way of expressing heat values of gases for purposes of comparison, let us apply the statement quoted and see what results would be obtained if the figures, as given, are correctly reported.

Water gas is well known to be richer in heat units than producer gas generated in any type of generator classed among the gas producers, i. e. those internally fired, yet its thermal value is only about 300 B. t. u. per cubic foot. A producer gas that yielded only one-fifth as many units would give 60 B. t. u. per cubic foot and would be too poor to use. We know, however, that gas producers using the Mond process have been manufactured for years, and satisfactorily used in many countries with all kinds of fuel as well as with peat.

The richest producer gas that could be generated from good coal probably would not exceed 200 B. t. u., as all reports available give from 100 to 180 B. t. u. per cubic foot as about the range in heating value, according to the type of gas producer and fuel used. If, for the purposes of discussion, 200 B. t. u. per cubic foot, high as it is, is assumed, it would make the figures quoted still more improbable, since gas containing but 30 to 40 B. t. u. per cubic foot is far below a blast furnace gas in thermal value, and this is about the poorest fuel gas now in use for any purpose.

It is well known that peat gives a producer gas quite as high in fuel value per cubic foot as coal gasified in the same type of generator, hence the figures as to the limits of thermal value cited above, would hold as well for gas generated from peat as that obtained from any type of coal, and the quotation given must either be incorrectly stated or interpreted.

From another point of view it may also be shown that the

figures quoted in the statement under discussion are invalid. It is well known to all the readers of this Journal that the Mond process gas producers are made by the Power Gas Corporation, L't'd, of Stockton-on-Tees, England. This company has been working on the problem of the gasification of moist peat in gas producers for at least ten years, and during that time has made numerous analyses of the producer gas generated from peat in their Mond producers; some of these analyses have been published, and, so far as the writer has learned, none of these have ever been disputed as improbable or unreasonable. Three analyses of this sort are published on page 18 of the last general catalogue issued by the Corporation and may be cited here:

Fuel used	German peat	Italian peat	English peat
Moisture content of fuel (per cent)	40 to 60	45	57.5
Heat value of gas produced, B. t. u. per cu. ft.........	150	166	134
Quantity of gas produced (cu. feet) per ton of theoretically dry peat............	85,000	60,000	90,000.

It is evident that gas with 5½ times "better yield in heat units generated than" that of the Mond process, as exemplified by these analyses, would have a fuel value of 825,913, and 737 B. t. u. per cubic foot respectively and if the supposed gas had "6 times better yield" these values would rise to 900,996 and 804 B. t. u. per cubic foot, far above the heating value of any gas except natural gas which may have a calorific value of about 1,000 B. t. u. per cubic foot. It may be well to call attention here to the fact that illuminating or retort gas, made by distilling coal in closed receptacles, averages, after purification about 650 B. t. u. per cubic foot.

If it is considered that the figures may mean that 5½ to 6 times larger volume of gas is yielded by one process than is given by the other, again the figures are entirely impossible, since the volumes of gas per ton of dry peat gasified given in the table above quoted, are well in accord with those published by experimenters working independently and with different types of gas producers, as well as with similar figures deduced theoretically by studying the chemical composition of the peat, and the processes and relations involved in the generation of producer gas.

The statement may be considered from yet another viewpoint, that of comparative efficiency of the two processes under discussion. The Mond process however, has proven its efficiency

by long commercial success; with some fuels this efficiency is reported as high as 85 per cent. Assuming, however, that with peat, the efficiency might be as low even as 70 per cent of the total heat units of the fuel gasified are made available for use, there is no possibility of another process developing 5½ or 6 times as great efficiency. Nor is it possible that if the other process developed an efficiency of 100 per cent that any other gasification plan that had been a commercial success could be only one-sixth as efficient.

It is evident, therefore, that there is no point of view from which the statements in the paragraph under discussion can be maintained as they were published, and in justice to the company making and selling Mond gas producers this statement is made.

C. A. D.

European Trip. The Editor returned from his short European trip in January. Later it is hoped to give the Society an account of some of the interesting things in the way of peat utilization seen in Germany, the only country really seen on the excursion.

The Flora of Peat Bogs. Contrary to what might be supposed, the plants which grow upon peat bogs do not present the typical appearance of marsh vegetation, namely, considerable height and thin leaves. As M. E. Coquide remarks, with regard to peat bogs in the north of France, that the somewhat paradoxical observation is made of plants on the damp soil displaying much the same general characters as the vegetation of dry soils, and he examines into the reason for this. In fact the peat soil, which is damp but not marshy, shows certain varieties of plants such as one also finds on dry soil of chalky or sandy nature. He concludes that such soil acts as if it were dry. The peat has such a great capacity for water that rain or other atmospheric water does not saturate it, and so there is a struggle between the soil and the plants for the water. The plant has powerful means for attracting water such as evaporation, capillarity, osmose and the like, but the peat also has a great evaporating power and it also retains water by capillarity, osmose and also by its colloidal nature. When the peat is nearly saturated, the plant can take more water, but after a dry spell the peat does not give up its water to the plant but even subtracts it from the latter and the plant may dry up for this reason. To thrive in such a soil, the plant must be of the proper kind or adapt itself by reducing its evaporating surface and increasing its absorbing organs. This very satisfactorily explains the character of the vegetation.

Peat Molasses for Cattle Feeding. Consul Herman La-Spahr, Breslau, Germany, reports that the use of molasses mixed with peat for cattle feeding was common some 10 years ago, but at present the demand has fallen off considerably. The ingredients now most usually mixed with molasses to be used for feeding purposes are wheat bran, brewer's drainings, palm kernel groats, or coconut groats. Nevertheless, there is still a regular sale for peat molasses. The present average wholesale price is 70.2 cents per 100 pounds.

A prominent local dealer in feed stuffs believes that importation of peat molasses for feeding purposes is almost impossible because of the high sugar duty, which would be prohibitive for peat molasses on account of the low selling price. Furthermore, he asserts that feed stuffs containing molasses are very difficult to ship over sea, as the molasses easily gets moldy under the influence of damp air. For the same reasons an export of peat molasses from Germany to over-sea countries is out of the question.

Peat in Maine. The following note was recently clipped from a New England newspaper:

"Superintendent Silas H. Harding of the First United States Life Saving District, who has just returned from a trip through Eastern Maine, predicts a great growth of the Peat industry in that section, where he reports thousands of acres of peat bogs, the available depth of heating material running from 5 to 25 feet. 'Within the next 25 years,' Superintendent Harding says, 'I believe that Maine's principal industry will be the production of peat for fuel.'"

It is well known that Maine, especially in the eastern and northern parts, has extensive deposits of peat of good quality for fuel. The citizens of the State are well aware of this fact, and, from time to time, reports have reached us from various quarters, that the production of peat fuel was soon to begin on a commercial scale within the state. In fact, in 1906 and the following years, there were one or two small peat fuel factories operated on an experimental scale in the State, with small production at too high a cost to be commercially successful. Later some work, also experimental, was done near Bangor, to test a new method of making peat fuel. This work was reported upon in this Journal (vol. 2, page 100; vol 3, page 23) and was carried far enough to satisfy those supporting it of the correctness of the principles involved in using the method employed.

Recently reports have come from reliable sources that interest was again being shown in plans for developing some of

the favorably situated peat deposits for the production of power. It is difficult to find capital, however, to develop, even demonstration plants for using peat, for capitalists are naturally somewhat loth to go ahead until it has been shown that peat fuel can be produced in the State in large quantities, and certainty enough, to make investment of their money a reasonably safe business proposition, and this has yet to be done. Who dares to go ahead without being shown?

Where can Power Generators for Using Peat Fuel be Found? It is a matter of regret that no single firm in America that has announced that it is ready to produce the machinery to make peat fuel, together with the boilers and properly designed furnaces, or suitable gas producers and gas engines, for converting the fuel into power. It is true, however, that satisfactory equipment could probably be assembled for all necessary uses, if the purchaser would share with the several manufacturers making it, the hazards of developing the various units so that they will work together efficiently and economically. Our members know well where the machinery for making the raw peat into fuel is to be had, but if a steam boiler plant were desired for turning the peat into power, to whom could we go with any certainty that a boiler outfit suitable for our chosen fuel would be forthcoming? Boiler furnaces designed for high grade coal will not burn peat economically, nor give the rated steam capacity with peat fuel, and the question that would confront any one wishing to buy a boiler that was thoroughly adapted to using peat fuel, would be, "Where can such a boiler be bought in the United States?" A similar question would arise in the mind of the seeker after a gas producer adapted to peat fuel, although recently certain manufacturers of gas producers are making producers that successfully gasify lignite in commercial operations, and without doubt, could modify their machines so they would handle peat fuel equally well. It still remains true, however, that one could not order a complete plant for producing and using peat fuel of any manufacturing company in this country known to the writer.

Nitrate of Soda, the chief natural source of the combined nitrogen used for fertilizer and other purposes comes largely from Chile. The world's consumption of this substance from January to November 1912 amounted to 2,321,011 tons. During the year 1912 the export tax collected by the Chilean Government on the nitrate of soda sent out from that country amounted to $31,196,846. Practically the entire world pays tribute to Chile for the very essential nitrate.

Annual Meeting. The Executive Committee held a meeting on March 27th in New York, and it was voted to hold the annual meeting at Montreal, Canada, and thus accepted the invitation of the Canadian Peat Society, extended through the Secretary, to hold a joint meeting. The two other places prominently before the committee were Chicago,Ill., and Jacksonville, Fla. The claims of both cities were carefully considered, but in view of the fact that very few members had expressed themselves in favor of either place and that neither could offer any practical working plant for inspection within reaching distance, while as the well known Farnham plant of Peat Industries, Ltd., is near Montreal, and will probably be in operation, it was decided to hold the meeting there.

The date in which the meeting will be held will be announced later, but in the meantime all members, whatever their individual preferences may be for a meeting place, are urged to make plans to go to Montreal and make this meeting a memorable one in the annals of the Society.

Dewatering Peat. About the middle of February, a conference was held in New York at the Engineers' Club on the subject of mechanically extracting water from peat as a preliminary step in the process of rendering it usable on a commercially profitable basis. There were present at this conference, J. N. Hoff, J. Bordollo, C. A. Davis, H. Condict, W. Strohn, B. Granville, W. B. Ruggles and several other well known engineers interested in the problem. The meeting was entirely informal and the whole question of drying peat for various purposes was carefully considered. The only new method presented was that of the German inventor Hencke, whose separator and process were described by Mr. Strohn. Mr. Strohn had just returned from Europe where he had seen the Hencke machine at work, and he reported very favorably on the results obtained by its use on various substances besides peat. As the statements made by Mr. Strohn were preliminary to more thorough investigation, he did not give figures as to capacity or costs of operation, but expressed the positive opinion that the machine was a practical one and applicable to commercial operations where peat was prepared for fuel or fertilizer uses.

Mr. W. R. Beattie, of St. Louis, Mo., a member of this Society, formerly on the staff of the Bureau of Plant Industry, U. S. Department of Agriculture, was a visitor in Washington, D. C., recently. Mr. Beattie is greatly interested in the practical utilization of peat soils for agricultural purposes; his article in this number of the Journal points the way to one im-

portant manner in which peat can be made a profitable use. Mr. Beattie is now Agricultural Commissioner of the St. Louis Southwestern Railway Company of Texas. It is hoped that he will long continue a contributor to the Journal.

Propaganda for the American Peat Society. Our tireless Secretary-Treasurer reports that in the past quarter he has sent out from his office about 2,500 letters, postal cards and circulars calling atention to the work that is being undertaken and advantages offered to its members by the American Peat Society. In order that these communications might reach people not already familiar with the work of our organization, an entirely new mailing list of 2,000 names was made up from reliable sources. As the result of all this work, a number of new members have been secured. One large concern sent in four subscriptions for different offices.

States Which Have no Important Peat Deposits. The States in the following list are reported as having no known large areas of peat or muck land within their boundaries. The information was obtained by writing to the various State Agricultural Experiment Stations and was usually furnished by the directors of the several stations or by the men in charge of the soil work.

As would be expected, it was reported also that no work was being done to determine experimentally the agricultural value of peat, or to investigate it as a possible fuel at the agricultural experiment station in these States: Alabama; Delaware; Georgia; Kansas; Kentucky; Louisana; Maryland; Montana, limited areas only; Mississippi; Missouri; New Hampshire, few areas of peat, except salt marshes near the coast; North Dakota; Oklahoma; South Carolina; South Dakota; Texas; West Virginia; Wyoming. Reports received from other states will be printed in a subsequent number of the Journal.

Foreign Members of the Society. The American members of this society may be surprised to learn that their Journal has an international reputation and that it is in demand, literally in all parts of the world. Among the new members who have joined the Society recently, evidently to receive the Journal regularly, since they can hardly hope or expect to attend the meetings with much regularity are two from Moscow, Russia and one from Canton, China. We also have members in various European countries and in South America.

PERSONALS.

President J. N. Hoff has been in the city of Washington, D. C. twice since the appearance of the last issue of this Journal, in the interest of the American Peat Society. His conferences with the Editor have resulted in the formulation of plans for increasing the scope of the work of the Society and these will be announced as soon as they are fully matured. It is hoped and expected that the undertakings will give new impetus to the Society and materially add to our knowledge of the value of peat soils and the methods of handling them for agricultural purposes.

Mr. John Wiedmer, President of the Springfield Filler Company of St. Louis, Mo., spent several days in Washington and vicinity in March. Mr. Wiedmer reported that the plant of his company at Manito, Ill., was being put in order for a vigorous campaign during the season of 1913. This plant has large capacity and is to be worked to the limit during the coming season.

Mr. Heinz Horst, of Neustadt, Germany, an engineer and a close student of the utilization of peat for fuel in Europe, as well as one of the inventors of what promises to be very important machinery for preparing peat for fuel, spent a day in Washington in March, prior to his return to Germany. Mr. Horst expressed himself as greatly interested in the possibilities of preparing and using American peat for fuel.

Dr. T. A. Mighill, recently reported that during the late fall and early winter he spent considerable time prospecting peat deposits in eastern Massachusetts in the hope of finding a suitable location for a demonstration plant. Bogs free from wood and peat low in ash were reported to be rare and at last accounts no satisfactory deposit had been found.

Mr. Robert Ranson, during the winter has been dredging peat on Pablo Creek, between St. Augustine and Jacksonville, Fla., and sun drying it, with a view to introducing it for use in gardens and other horticultural and agricultural purposes. He reports that the peat prepared in this way gives excellent results on the sandy soils of Florida and that there is considerable demand for it. It is well known that Mr. Ranson is enthusiastic over the value of peat for fertilizer on poor soil.

Mr. Carl G. Kleinstuck has had a very hard winter. He was unable to manufacture his usual supply of peat fuel during the summer of 1912 and in consequence had to burn anthracite coal during the winter just ending, and the labor of attending his furnace fires was so much increased thereby that he will begin making peat this season as soon as the ice is gone, to insure proper supply for next winter's fires.

Mr. C. Lindley Wood, of the Power Gas Corporation, L't'd, Stockton-on-Tees, England, was in this country for a brief stay in March and made a very pleasant call on the Editor before returning to England. He reported that the gas producer and ammonia recovery plant installed by his company at Pontedera, Italy, was giving very satisfactory returns on the investment. The new Italian Mond gas plant being erected at Codogoro, Province of Ferra, is nearly completed and will soon be in operaeion.

Mr. B. F. Haanel, B. Sc., Chief of the Fuel Testing Division and Engineer in charge of the Gas Producer Investigations of the Mines Branch, Canada Department of Mines, spent a few days in New York in February, on official business connected with his work on peat. Mr. Haanel had at that time recently returned from a trip to Europe, where he had been sent by his government to study the large producer gas plants of the Continent. While in Europe he also investigated methods in use in the countries he visited to prepare peat for fuel. His report on the results of this trip will be looked forward to with great interest by all members of the Society.

The Saugus River Peat Company, formerly operating a small plant at Lynnfield, Mass., for making peat fuel and litter, after suspending work for 3 years, reports that it will rebuild the building which was destroyed by fire last winter and begin to produce peat products on a considerably increased scale during the present (1913) season. May the rejuvenated company have a prosperous career.

The East Lexington Plant, which those who attended the Annual Meeting of this Society held in Boston, Mass., in 1909, will remember was then operated as a briquetting factory for making peat briquets, is to be fitted up, after two seasons of idleness, to make peat fertilizer filler. The old company has reorganized, it is reported, and will be on a better basis than ever before and as there is a good local demand for its product, prospects seem bright for final commercial success.

The Peat Company, Incorporated, has opened an office and salesroom at No. 130 Manhattan Street, near Broadway subway station, New York City, for the sale of peat moss stable litter and peat mull or dust. It is announced that this company will carry a stock of the best quality of peat litter obtainable from foreign makers, until such time as a superior article can be produced in the United States in sufficient quantity to supply the market. The constantly increasing production and use of peat of the more fibrous kinds for stable litter and of peat dust for sanitary purposes in the countries of Northern Europe, indicate that both articles are unusually well adapted to these uses. There seems to be little difficulty involved in their preparation, and it is hoped before long that someone will start manufacturing in this country.

The Peat Liquid Products Co., Incorporated, was incorporated under the laws of Delaware in March, 1913, for the purpose of manufacturing from peat and other mineral or vegetable substances a volatile liquid, that can be used as a substitute for gasolene and all similar products. The authorized capital is $6,000,000 and the incorporators are reported to be H. O. Coughlan and Joseph F. Curtiss of New York City.

Dick's Peat-Moss Insulating Plates, manufactured from high-grade Sphagnum peat in Germany and Holland, are being introduced as a substitute for sheets of cork and similar materials for insulating rooms to make them sound proof, or heat or cold proof. The sheets of peat insulator can be made 20 by 40 inches and of any desired thickness from one inch, upward. The sheets are very light, may be made fireproof by chemical treatment, and it is claimed by the inventor that they can be made at a very low cost. This form of peat is well adapted for use in refrigerators, cold storage rooms or for ordinary building construction. A similar material has been in use in the United States for some years, but is made of mineral wool, instead of peat, and is somewhat heavier than the peat material.

The Farmers' Farm Company have announced that the large peat filler plant at Plymouth, Ohio, which has been operated by the company for some years will be closed and dismantled. The machinery consisting of driers and other equipment has been offered for sale and the large factory buildings are to be converted into a canning factory, and the peat deposit, which is an excellent one, is to be farmed more extensively than in past years for the production of truck and other crops. The cause for discontinuing the production of

peat for fertilizer filler was stated to be the decreased demand, low prices obtainable and the high cost of production because of wet and cool summers.

Dr. W. Wielandt, whose peat-coke and by-products plant at Elizabethfehn, Germany, was visited by the Editor in December, 1912, reports that the demand for his product is increasing and that he has also received orders for several of the automatic digging, macerating and spreading machines described and illustrated in this Journal (Vol. IV, p. 151). The introduction of power peat digging machinery in all parts of Europe where peat is used for fuel is going on very rapidly.

CORRESPONDENCE.

Journal of the American Peat Society:
Washington, D. C.

Gentlemen:

In compliance with your request of February the 18th, I herewith submit replies to your inquiries, seriatim.

1. Comparatively little swamp lands exist in Tidewater, Virginia, outside of the great Dismal Swamp, but recently enacted laws have started their reclamation with gratifying results. In North Carolina, immediately tributary to Norfolk, immense areas of swamp land have remained neglected until within the past 10 years. Broad, liberal laws patterned after those of Indiana became operative in 1909, since which date over 300 miles of canals have been dug, while as much more is, or will be, in process of construction almost immediately. The results have enriched all the pioneers and are satisfying many more who were opposed to any enroachment upon old-time methods. In fact the educational features of this action have brought about almost as much benefit as actual accomplishments, for North Carolina has 2,800,000 acres of swamps and 6,000,000 acres of lowlands. The Valley of the Nile Celebrities are not more fertile than many of these lowlands, where centuries of vegetable deposits have mingled with mountain mineral seepage and interior hillside wastes.

2. The recovering of these lands has stimulated ambition, relegated prejudice, convinced the skeptic and made money for all who were enterprising.

3. Corn is the first crop planted, realizing as much as 90 bushels per acre without a particle of cultivation (see printed matter). Peas, potatoes, cotton, alfalfa, oats and other crops follow.

4. No peat has so far been used in fertilizer, as no fer-

tilizer is needed in the first stages after drainage, lime alone being applied to release the chemical properties of the humus. In one section an analysis of land reveals a greater percentage of fertilizing chemicals than exists in the high-grade commercial fertilizers.

5. Have no knowledge of any experiments in peat for either fuel, power, gas, stable bedding or any other industries. This may be due to the fact that only a small percentage of these lands are peaty as evidenced by their being subjected to very trying experience in clearing with fire, without injury to the land itself, as would be the case if it were of that nature.

Yours very truly,

JORDON & DAVIS CO., Inc.

Norfolk, Va., February 21, 1913.

ABSTRACTS, REVIEWS AND PATENTS.

Florida State Drainage: Realizing the extent and importance of draining the Everglades, the Florida State officials have undertaken the work. This marsh is about 140 miles long and 50 miles wide, covering the larger part of the State. It is not a swamp in the commonly accepted sense of the term, for the water is clear and wholesome, and has a slow current. The Everglades consist of a vast number of small, low islands separated by channels in which the water is generally shallow (rarely exceeding ten feet in depth) and is concealed by tall grass. Fish abound. The islands are covered by dense masses of pine, palmetto, together with tropical shrubs and vines. The country was wild and rich in small game. During the Seminole war in 1835 the Indians ambushed and destroyed in the Everglades a body of United States troops under Major Dade, and were not driven out until after a struggle which cost the Government 1,500 men and $10,000,000.

The United States Senate has published a document relating to the Everglades of Florida and their reclamation. As early as 1848 investigation led to the belief that the Everglades could be reclaimed by drainage. Later the State received the region from the United States on the express condition that she would drain the region and render it cultivable. The first dredge began throwing dirt on July 4, 1906. The work of digging the main canal is financed by the State. The outlet to the gulf is completed, and one to the Atlantic will be finished next February or March.

(The Clay Worker, Vol. 59, p. 47) H. P.

Right to Drain: The Alabama Supreme Court (Walshe vs. Dwight Manufacturing Company, 59 Southern Reporter 630), decided that:

A land owner may, in order to better farm his land, drain surface water upon the lands of a lower neighbor, but he cannot create new channels or make ditches which cast water upon the lower lands in a manner in which it has not been accustomed to flow, to the injury of the neighboring owner.

(The Clay Worker, Vol. 59, p. 47) H. P.

National Drainage Congress. (Engineering Record). The third annual meeting of the National Drainage Congress was held at St. Louis, April 10-12. The meetings began with the morning session of Thursday, April 10, at which time there were addresses of welcome by the president and responses thereto. At the afternoon session an important paper was presented by Col. C. McD. Townsend, of the Corps of Engineers, U. S. A., and president of the Mississippi River Commission. This was followed by a paper by Mr. Isham Randolph, consulting engineer, of Chicago, who controverted some of the opinions expressed by Colonel Townsend. Mr. Randolph also advocated the creation of a Department of Public Works in the national government, with a secretary at the head, who should have a seat in the President's Cabinet. He called attention to the fact that the vast expenditures for public works in this country needed the attention of a much larger engineering force than West Point is able to turn out, and that, in keeping with the excellent service in many foreign countries, we should place such work on the basis of being directed by a Cabinet officer. Mr. Randolph also served as chairman of the resolutions committee, which presented a very strong, direct and comprehensive resolution on this subject, which appears later.

While it is impossible to mention all of the papers, a few of particular interest will be outlined. The illustrated address of Prof. Wilhelm Miller, assistant professor of landscape horticulture in the University of Illinois, on the new way of planting roadsides and waterways was particularly interesting.

The address on Friday morning of Mr. Frank B. Knight, of the Lidgerwood Manufacturing Company, of Chicago, entitled "The Business Man's Interest in Flood Protection," expressed well the dependence of the entire country upon the successful development and growth of products in the Mississippi Valley. The address of the same afternoon of Dr. William A. Evans, of Chicago, entitled "National Drainage and National Health," explained the much greater but less spectacular disasters

which occur as an aftermath of floods from insanitary conditions. He also spoke of the close relationship of the problems of malaria with swamps and overflowed lands and the fact that this disease may be largely eliminated, if not entirely so, by the drainage of such lands and that the resulting economic saving amounting to $160,000,000 per year in this country, would much more than pay for the cost of the work.

The evening session of Friday was taken up by an illustrated address by Mr. Marshall O. Leighton, chief hydrographer of the U. S. Geological Survey, entitiled "What Shall We Do with the Mississippi River Basin, the Greatest Industrial Plant in the World?" The burden of Mr. Leighton's remarks was that the whole river system of the Mississippi Valley should be considered as a unit and studied for all the purposes and uses to which the water could be put, and that no one purpose should be allowed to overshadow any other; that the strong and weak points of the system should be ascertained, particularly that we should increase (as upon all other river systems) our knowledge with regard to the hydraulics of the streams, in order that we may wisely solve the problems which arise from the pleadings of those who desire levees only, of those who wish reservoirs to aid water powers or improve navigation, of those who desire prevention of floods and of those who wish to irrigate arid lands.

The session of Saturday morning, at which the resolutions were adopted and election of officers took place, closed the meeting, except for an excursion on Saturday afternoon to visit the East St. Louis Drainage District. The resolution suggested by the committee and passed by the Congress, which is most important and fundamental in effect and is directly in answer to the request of the President of the United States that this Congress formulate some comprehensive plan that such disasters as those which have recently occurred shall not continue, is as follows:

To the President and the Congress of the United States:

Whereas, in view of the appalling and ever-recurring disasters caused by floods, which have destroyed life and property throughout the United States, and which are emphasized by the recent and widespread calamity brought upon our citizens by the floods which have devastated Ohio, Indiana, Illinois and adjoining States, and which devastating floods are now moving southward throughout the Mississippi Valley, threatening destruction to life and property all the way to the Gulf of Mexico; and

Whereas we believe it to be an equally proper function of the Government of the United States under the welfare

clause of the Constitution to take adequate measures to control the water resources of our country, so as to protect the life, health and property of our citizens from the controllable forces of nature as it is to protect our citizens from the attack of a foreign power.

Now, therefore, be it resolved by the National Drainage Congress, in which thirty-nine States are represented in convention assembled, That we respectfully petition the immediate consideration of adequate provisions for flood control, for the regulation and control of steam flow, and for the reclamation of swamp and overflow lands and arid lands, and in furtherance thereof we pray that in your wisdom you create a body at the earliest moment possible such plans, in conjunction with the several States and other agencies, as will meet the needs of the several localities of the United States, and we believe the most effectual and direct means will be the establishment of a Department of Public Works, with a secretary in charge thereof, who shall be a member of the President's Cabinet.

Be it further resolved, That the wide scope of the problem of flood-water control, affecting practically all the States of the Union, can best be conducted under the immediate supervision of the President of the United States in the exercise of such authority as is conferred upon him by the Congress of the United States.

Peat Deposits—Geological Survey of Ohio—Bull. No. 16. Price $0.75.

Peat literature can count another detailed work among its achievements. This book, which is prepared by Professor Alfred Dachnowski, of the Botanical Department of Ohio State University, is a close geological and scientific study of the peat deposits of Ohio and estimate of their value and extent. The work leads us through the elementary definitions of muck, humus and peat, their geological formation and the necessary changes the vegetable matter has to pass through tc form peat deposits. The methods of procedure in the investigation and the distribution of deposits in Ohio are taken up in alphabetical order and illustrations are supplied.

Chapter No. 4—on "The Uses of Peat" is from the pen of Prof. Chas. A. Davis and is largely adopted from his Bulletin No. 16, of the U. S. Bureau of Mines.

The development, adaptation, ecology and cultivation of the Ohio deposits forms the second part of this work, which is one of the most interesting scientific contributions to peat literature we have yet come across.

Part three handles the climatic conditions as a controlling factor and treats of the physiological and chemical properties of the deposits. The book is handled not only from a scientific point of view, but also from a practical standpoint. The work has been prepared with great care and is worthy of the attention of all "Peaters." H. P.

Development of Peat Production in Russia. The very high price of oil, which has reached 1 cent per pound in Moscow, has obliged consumers to use every effort to find a substitute or limit consumption. For instance, the Sormovo works, which had increased their consumption of liquid fuel from 2,000,000 poods to 3,176,000 poods (36,112 to 57,346 short tons) per year, have again limited the consumption to 2,000,000 poods, and at the same time are developing the production of peat, buying wood, etc. They are said to have purchased about 260,000 acres of Government land, on which they will produce peat fuel and construct gas works and an electric station.

The Moscow Electric Co., which consumed 2,500,000 poods (45,140 short tons) of oil in 1911, has purchased an extensive area of peat swamps and is starting the production of peat with improved machinery.

The supply of peat in the central Provinces is immense, and there is no cause for apprehension that it will prove insufficient. (Consular Report, Moscow.)

California Swamp Reclamation. That the West is also actively abreast of the times in regard to making use of swamp land is shown by a report that about 1,000,000 acres of swamp land in the Sacremento Valley, California is to be reclaimed for fruit culture. H. P.

Change of Name. The publishers of Mines and Minerals announce that with their March, 1913, issue, the publication will resume its former name "The Colliery Engineer" and will be devoted entirely to Coal Mining and Preparation. H. P.

Peat Power Station. The central power station at Schwegermoor, Germany, has now been running smoothly for some time, although at first difficulties were encountered. The trouble to obtain a dry enough peat will also be overcome.
H. P.

Swedish Peat Fuel: The Swedish Geological Commission has petitioned the government for a grant with a view to having the great resources of southern Sweden thoroughly examined.

In the petition it is admitted that the peat industry has not shown quite such progress as was anticipated, but several factories have lately been erected, and a new company has been formed at Helsingborg under the name of A. B. de Laval Peat-Coal Co., for the purpose of making peat fuel according to a process invented by Dr. de Laval.

(Mining & Eng. World, Vol. 25 p. 1148) H. P.

Marshland Development—Tree Planting in Mexico: The Department of Fomento has taken up with the Department of Hacienda the question of turning over to Fomento for division the marshes of Zapotitlan and Tuyahualco. These ancient marshes are held by the Department of Hacienda and are thought to be suitable for drainage and cultivation as are the floating gardens of Xochimilco. Means of transportation to Mexico City are abundant, as there are the Xico Railway, the street cars, and the Santa Anita Canal.

Miguel Angel Quesada, Chief of the Forestry Bureau, has gone to Vera Cruz to inspect the construction of artificial dunes which are planted with trees, the purpose being to prevent the enroachment of the sands on land about the port of Vera Cruz. (Daily Herald, Mexico City). H. P.

A Peat-Briquet Factory has recently been established near St. Petersburg. The plant, which is equipped with machinery invented by a Russian, started work on a small scale, but the results obtained are so promising that negotiations are under way for constructing similar plants near Moscow to furnish peat briquets to the Moscow-Kazan Railway. It is maintained by persons well versed in this matter that peat in the form of briquets can successfully compete with both coal and oil.

(Consular Report, Moscow.) H. P.

The Clay Worker, Vol. 5 p. 47, has the following to say regarding **Permanent Tile Drains:**

One great advantage in tile drainage is that, when properly constructed, the improvement is permanent. It never has to be repaired or renewed. There are tile drains in operation doing good service that were made generations ago. There is no reason why drains made of tile as they are made today should not last for hundreds of years to come. The fact is that tile drains usually pay back their cost in one or two years. That is they pay 50 or 100 per cent on the investment the first year and continue to do so without additional outlay.

Russian Peat: The utilization of peat in the central in-

dustrial districts of Russia has reached a point very little known elsewhere. The figure of 1909 is given by "Engineering" for the Moscow, Vladimir, Riazan, Kostroma, Nijni-Novgorod, Tambov and Kazan Governments at one million tons of output which represented an increase of 8.32 per cent over the output of the previous year. Most of this output is consumed by the exploiters in their own factories, very little being sold. In relation to coal and crude oil in this area the consumption is—coal 23 per cent, crude oil 44 per cent, peat 33 per cent. The average distance between the bogs and the mills is 7½ miles and the cost at mill 9s. per ton. Coal costs L-1-2-1 per ton and crude oil L-2-2-11 per ton, while the values of these two fuels that would make them the equivalent of peat would have L-1-0-2 and L-115-9 per ton respectively. It is thus seen that value for value both are more expensive than peat and that the exploitation of the latter is likely to continue as long as it lasts, that is, for perhaps a hundred years, at the same rate of consumption. Some tests have been made on the railway which showed that with an average sample containing 25 per cent of water and 5 per cent of ash the weight of water that a pound of fuel evaporated at 212 degrees F. was 3.19 lbs. Higher results than this have been obtained on a German railway and higher still in some Russian cotton mills with special mechanical stokers where 4.46 lbs. of water were evaporated per pound of peat fuel consumed. There are other parts of Russia, notably the Ural Districts, where thousands of acres of peat bogs exist and where only wood and brown coal are at present used. Such areas could be easily developed, more particularly if the modern idea were adopted of first converting the peat into gas and then using the gas in gas engines. In this way an additional 75 percent of efficiency can be gotten out of the fuel.

(From Indian Engineering, Vol. 52, p. 346.) H. P.

PATENTS.

Peat Fuel and Coke: W. L. St. Julien Prioleau and J. R. H. Prioleau. Br. Pat. 28145 (1911).

This invention relates to a method of treating peat for use as fuel, or for forming peat coke, and to the apparatus by which the process is carried out. The invention comprises the drying of the peat in two distinct stages—the one being really a heating process and the other a cooling process—the utilization, in the second stage of the damp heat evolved in the first stage, and an intermediate step in forming the partially dried peat into soft shapes, or blocks, by moderate pressure, which are afterwards condensed by cooling and drying in the second

stage and without pressure. An essential feature of the complete process is that the crude peat is thoroughly disintegrated and the fibrous matter broken up before the preliminary heating is attempted. The preliminary drying stage then effects the drying of the peat in such a manner that not more than about half of its moisture is extracted from it at the same time that the peat is raised to a temperature of about 100 degs. Cent. The drying and heating are effected by causing a thin layer of the disintegrated peat to traverse a hot chamber subject to surface heating only, so that it is not harmfully effected by products of combustion or the like. Preferably the disintegrated peat will pass slowly through the hot chamber on travelling bands which deliver it to a briquetting machine. The moisture remaining in the peat, together with its own constituents, in view of the heat to which it is raised, provide sufficient binding effect when subjected to moderate pressure to make a soft briquette which will retain its shape. The briquettes thus made are taken to a drying shed, the special feature of which is that by utilising warm air containing some moisture the cooling and drying is effected slowly in a current of moist air, and at a temperature of about 35 degs. Cent. The drying is continued for several days until ordinarily only about 2 per cent to 10 per cent of moisture remains in the blocks. If, however, a higher percentage of moisture may be allowed in the blocks, the drying period is correspondingly less. The heat required for this purpose is conveniently obtained by carrying the air from the preliminary heating chamber into the drying sheds and exhausting it after receiving its additional moisture by means of fans, a high chimney shaft, or otherwise. A convenient arrangement is to place the heating chamber in proximity to a line of coke ovens so that the gases therefrom or some of them may pass directly to the heating chamber flue, or flues, and to further arrange the drying sheds on each side of the central heating chamber,—say, for instance, three on each side thereof, with connecting flues so that any one or more of the drying-shed flues may receive the heat from the central-chamber flue. H. P.

Wet Carbonizing of Peat: T. Rigby and N. Testrup, Br. Pat. 19330 (1911).

This invention relates to a method and apparatus for wet carbonizing peat and the like. According to the invention the carbonizer may be heated to a predetermined temperature and maintained thereat without difficulty and without risk of local overheating. The invention consists in furnishing the necessary heat to one or more wet carbonizing elements by means of steam under suitable conditions as to pressure and tempera-

ture, the tube or tubes preferably being enclosed in a boiler shell, and steam admitted and distributed directly against them.

H. P.

Removing Water from Wet-Carbonized Peat: T. Rigby and N. Testrup. Br. Pat. 24748 (1911).

This invention relates to the removal of water from peat wet-carbonised by a process such as that described by Ekenberg. It has been observed that the water contained in peat so treated can be reduced only to, say, 70 per cent in filter presses or the like, unless the time consumed and pressure required are extremely great, and to overcome this difficulty the water removal is completed to the desired extent either by treatment is a band or like press, or by drying the press cake material in a current of hot flue gases from an element in the installation. According to the present invention an alternative method is provided by carrying out the treatment last referred to in a particular way. To this end the known drying method is utilized, consisting in suspending the material to be dried in a current of hot gas and hot flue gases are employed from an element of the installation as has been proposed for drying pressed or drained raw peat. This invention consists, therefore, in dispersing the peat to be dried in a finely divided state in hot flue gases from the furnace of the carbonizer or the like, and causing the peat to remain dispersed in this atmosphere until it has become dried to the desired extent.

H. P.

Producer Gas from Peat: A large weaving factory in England reports gratifying results from the use of peat for the production of gas for motive power. It seems that the peat, originally containing 80 to 90 per cent of moisture, is dried in the open till it contains only 25 per cent, when the blocks are placed in a feeding hopper, from which they pass to the producer, where gasification of the fuel takes place by partial combustion, and crude gas results, quite as rich as that obtained from anthracite coal. The gas is driven off, cooled, purified, the by-products removed, and the clean gas passed into a gas holder ready to supply the engine. It has been found that peat gas giving over 16 brake horsepower is obtained at a cost for fuel of only 1d. per hour. The peat costs 6s. a ton, as compared with 32s. for coal, two tons of peat going as far as one ton of coal.

(Steam, Vol. 9, p. 60.) (This probably refers to the Potadown plant in Ireland. (See this Journal, Vol. 5, pp. 53, 163 and 236.)

H. P.

Foundry Coke from Peat: In Vol. 5, p. 204, of this Journal

we reported regarding the activities of the Peat Coke and Oil Syndicate. In Vol II, p. 48 of **Steam,** further activities regarding this company are reported as follows:

An English company claims to have perfected a new process for the utilization of peat from the extensive peat moors around Doncaster. For some time, says the **Sheffield Telegraph,** experiments have been made with peat to prove its commercial value as a fuel, with the result that this company is now about to commence the manufacture from peat of a foundry coke for steel smelting, its special features being the low percentages of sulphur and ash—viz., 0.04 sulphur and 4.70 ash. Exhaustive tests warrant the company's erection of a plant to manufacture the coke for steel smelting and for use in suction gas plants. It is understood that a site has been secured for the works, with siding accommodation communicating direct with the peat moors, and contracts have been arranged for the supply of peat. Large orders are in hand for the manufactured coke from some of the largest steel makers, including leading Sheffield firms, which have had samples submitted to them. H. P.

The Nitrogen and Humus Problem in Dry Farming: By R. W. Thatcher, Wash. Agri. Expt. Sta. Bull. No 105.

From this investigation the author recommends that the humus supply of the soil be increased by regularly plowing under the stubble and straw which is grown on the land, supplemented by any green cover crop which conditions will permit to grow during the late fall or early spring months. All such material should be plowed under as deeply as possible, and should preferably be chopped up and mixed with the soil by thorough discing before plowing. Treated in this way, it can be put into the ground in good shape to decay and with the least possible danger of causing the soil to dry out so that the following crop will "burn out." Crops grown on lands which have their humus supply deep in the soil will naturally develop deeper rooting systems and will be able to withstand drought and to draw larger supplies of plant food.

On dry farming lands whose chief characteristic is deficiency in humus and nitrogen, farm manure is of exceptionally high value as a soil renovator. Every available ton of manure should be carefully husbanded and utilized by plowing deeply into the land after first scattering it on the surface and discing thoroughly. H. P.

The Peat and Muck Deposits of Vermont: By J. L. Hills and F. M. Hollister—Vt. Agri. Expt. Sta.—Bull. 165.

Peat and muck are not the same thing, though the words are commonly used interchangeably. The former is a less dis-

integrated product than is the latter, which is often no more than a highly organic swampy soil. They are similarly formed, however, and intergrade. They are formed in wet and ill-drained areas from diverse aquatic and other plant growths and occur throughout the areas formerly altered by glacial action. Chemically they contain organic matter, nitrogen in varying quantities, and relatively little available mineral plant food. One peat may be moss-like in character; another, more truely a muck, may be a positive mud. They are dark hued, very absorbent and of varying weight and density.

Hackensack Meadows: Frequent reference has been made to the unproductive swamps around New York and now the owner has at last begun to place nearly 100 acres of the Hackensack Meadows, near Rutherford, N. J., under cultivation. The muck soil is about 5 feet deep resting upon a bed of clay. Ditches have already been dug. An experimental two-acre farm is to be started at once this spring and we understand one acre will be heavilly fertilized, while the other will be heavily limed and all kinds of vegetables will be tested out. H. P.

Frank-Caro Process: In the Eighth International Congress of Applied Chemistry, Carl Duisberg referred to the recent use of peat gas in his lecture on the "Latest Achievements and Problems of the Chemical Industry." He said in part: "The manufacture of by-products goes hand in hand with this more direct generation of energy from fuel. These products include ammonium sulphate of such great importance in agriculture and the tar-distillation products so indispensible in the color industry. The latest and most rational method of utilizing the peat or turf beds, so plentiful in Germany and in many other countries, is practised in Schweger Moor near Osnabruck according to a process discovered by Frank and Caro. There peat gas is produced and utilized and ammonia obtained as a by-product, the required power being generated in a 3000-H. P. central electric power station. The moorland, after the removal of the peat, is rendered serviceable for agricultural purposes.

At that place, nearly 2,500—2,600 cubic meters of gas with 1,000—1,300 calories of heat were obtained from 1,000 Kg of absolutely water-free peat in the form of air dried peat with 45 to 60 or 70 per cent of moisture. This gas represents energy equal to 1,000 H. P. hrs. equal to 700 K. W. hrs. after deducting the heat and power used for the operation of the gas works. In addition 35 Kg of ammonium sulphate were produced from the above quantity of peat which contains 1 per cent of nitrogen." H. P.

Peats are commonly used as fuel in other countries, occa-

sionally in this country. An interesting account of Vermont usage of peat fuel is contained in this work. It has many strong points in its favor and while not likely to displace coal and wood, is often worth using. Agriculturally it is used as a fertilizer and soil amendment, as a stable absorbent and litter, as a stock food and in commercial fertilizer manufacture. Its service as a fertilizer and soil amendment and as a stable absorbent are well worth while.

A survey of Vermont peat and muck deposits was made several years ago. Some 200 samples were drawn from all sections of the State and analyzed. The location and description of the more important deposits is included in the bulletin, as are also full analyses showing the fertilizer and fuel values. The general nature and properties of the several deposits are discussed by counties. Among the more important large deposits may be mentioned those in and around Bristol Pond and Shoreham Swamp in Addison County; the 100-acre area in South Burlington, which is of high fuel but rather low fertilizing value; large deposits in Franklin, Highgate and Richford in Franklin County of high value for fuel purposes; the large number of high grade deposits in Grand Isle County, particularly Isle La Motte North and South Hero; and the extensive area in the town of Stratton, Windham County. H. P.

Small Gardens for Small Folks: By Edith Loring Fullerton, pub. by W. Atlee Burpee & Co., Philadelphia, Pa.

A booklet which contains among other things the method of applying humus to the soil.

The Lure of the Land: By Edith Loring Fullerton, pub. by the Long Island Railroad.

This book contains the story of the work carried on by the Long Island Railroad Co. Experimental Stations at Wadding River and Medford in Suffolk County, N. Y. Mr. Fullerton who took hold of this land for the Railroad Company in 1905, when it was a waste sandy loam soil, has developed the same, by effective, intelligent and generous use of peat humus to the sandy soil. The book deals in detail of the work of clearing, ditching and preparing the soil for producing the conditions of successful truck farms, and our readers have noticed from previous references in this Journal that the work has prospered beyond the anticipations of 1905.

The work represents perhaps the most intelligent and inspiring piece of literature relating to making useless farms effective vegetable and fruit producers. We cannot close the book without retaining the most pleasant impressions and earnest realization of what can be accomplished on poor soils, now lying useless, by the application of scientific methods. H. P.

Humus, Long Island Agronomist, Vol. 6, No. 8, p. 11, 1913, writes: "The prosperity of our country is primarily dependent on soil production, which fails when humus is gone. It is therefore with wonder that we look upon large acreage of "waste" land, much of it peat or muck swamps—practically all humus." H. P.

Swamp Lands in Virginia: Late reports from this state indicate that some drainage has been done by private individuals in the eastern part of the State, but that little or no work has yet been done by State or county. A law was recently passed by the legislature permitting certain sections to form drainage districts and proceed to the drainage of swamp lands, but, so far as known at the State Agricultural Experiment Station, no work has as yet been done under the provisions of this law. Some lumber companies are draining a part of their swamp lands from which they have cut lumber and the land is being reclaimed for agriculture.

STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.

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Business Manager.

Sworn to and subscribed before me this 21st day of March, 1913.

(SEAL) My commission expires March 30th, 1913.)

MELVIN C. HASCALL,

Notary Public.

American Peat Society

If you are interested in any degree whatever in Agriculture, Power and Fuel, Chemistry or any other uses of Peat, you should let us help you and you help us by becoming a member of the American Peat Society.

OBJECTS AND FOUNDATION.

Founded at the Jamestown Exposition on October 23d, 1907. Its object is to further the interest in the uses and application of peat for industrial and economic purposes.

PUBLICATIONS.

The Society holds one general meeting per year, and publishes a Journal quarterly, which is sent free to all members in good standing. The journal includes the proceedings of the meetings, original papers on practical experience, etc., also abstracts on all contemporary literature and patents, thus all the latest agricultural uses, fertilizer purposes, drainage, fuel, uses, technical uses, etc.

SOME ECONOMICAL POINTS OF INTEREST.

Prof. Chas. A. Davis, U. S. Bureau of Mines, estimates that there are about 12,000 sq. miles of workable peat beds in the United States, outside of the large number of beds very advantageously adapted for agricultural purposes, etc. He gives as a conservative average estimate a yield of 200 tons dried peat per acre foot.

Canada has at least 37,000 sq. miles of known peat deposits.

About ten million tons of peat fuel are used in Europe each year.

GENERAL INFORMATION AND ENQUIRIES.

All members have the privilege of making enquiries regarding general information about peat and its uses, by addressing the Secretary of the Society.

It must be understood that only general information and of a general character can be given. Members can obtain the names of experts in any special line, from the Secretary of the Society.

Journal of the American Peat Society

VOL. VI | JULY, 1913 | No. 3

THE RECLAMATION OF THE SWAMP AND OVERFLOWED LANDS OF THE SOUTH ATLANTIC STATES.

By Dr. Joseph Hyde Pratt, State Geologist, North Carolina.

The value of the swamp areas of North Carolina and the South Atlantic States has been appreciated and realized for a great many years, but it has only been very recently that it has become practicable to thoroughly drain them and reclaim the land for agricultural purposes. These swamp areas are in the Coastal Plain Region and represent an area of approximately 2,883,200 acres. The most of these swamp areas are of sufficient altitude so that they can be drained by gravity, but on certain areas it will be necessary to erect pumping stations to take care of the last part of the water. In the following table the approximate area of each of the South Atlantic States is given:

	Square miles
Virginia	600
North Carolina	4,505
South Carolina	4,870
Georgia	4,210
Florida	30,930

The reclamation of these swamp areas in the different States offers very similar problems with the exception, perhaps, of the drainage of the large swamp areas of Florida, so that a discussion of the problems of one State and what that State has accomplished will give a fairly accurate idea of the conditions and the problems of the other States.

Florida has done more from the standpoint of the State to reclaim its swamp lands than any other of the southern States, but, up to the present, more practical results have been

obtained in North Carolina, and the problem has probably been more systematically worked out in this State than in any of the others of the group of States referred to.

In North Carolina there are approximately 4,505 square miles, or 2,883,200 acres, of swamp land, a large proportion of which is susceptible to reclamation. This swamp area lies in 28 counties in the eastern part of the State, the proportion to each county being shown in the following table:

	Square miles		Square miles
Beaufort	177	Hyde	387
Bertie	57	Jones	139
Bladen	192	Martin	86
Brunswick	300	New Hanover	25
Camden	162	Onslow	134
Carteret	126	Pamlico	325
Chowan	80	Pasquotank	80
Columbus	300	Pender	370
Craven	238	Perquimans	92
Cumberland	30	Pitt	40
Currituck	40	Robeson	130
Dare	344	Sampson	18
Duplin	125	Tyrrell	251
Gates	45	Washington	262

Total..........4,505 square miles or 2,883,200 acres

This area is nearly as great as that of the Kingdom of Saxony, which has a population of nearly five million people, or nearly double that of the total population of the State of North Carolina. It is not stating it too strongly to say that, with this swamp area thoroughly drained and cultivated, eastern North Carolina could easily support a population considerably greater than the present population of the State. Although some of the swamp areas do not contain land that is very well adapted to agricultural purposes, still there are vast areas that, if drained, would be capable of growing a vast variety of products. These reclaimed portions would not be far from railroad transportation, so that the products of the farms could be easily marketed.

There are three distinct types or classes of swamp areas in eastern North Carolina.

The first is the great gum and cypress swamp, which occurs in a long, narrow belt, ranging from one-quarter to 2 miles in width, or, in an extensive area, several miles in diameter. Originally this class of swamp was heavily timbered in cypress, gum, maple, poplar, and ash. At the present time, however, most of this timber has been removed or is under contract to be removed in the near future. This type of swamp land is especially adapted for agricultural purposes, when the excess water is removed. On the other hand, it has little value for reforesting and for second growth, so that unless such land is drained, it will yield to its owner practically no revenue whatever.

The second type of swamp is known as the pocosin or open marsh and is found in large areas in Onslow, Carteret, Jones, Craven, Pender, Pamlico, Tyrrell, Washington and Dare Counties. These areas contain only little timber, and that is of poor quality.

The drainage of this type of swamp has to be deeper and the soil is not as easily brought into a good state of cultivation as that of the first class of swamps.

The third class of swamp lands constitutes the higher lands along the swamp areas, on which it is possible to raise crops in certain amounts, but they are constantly being drowned by the excessive rainy weather, and practically most of the time represent a swamp area.

The most noted area in North Carolina is the Dismal Swamp which is 15 to 20 miles wide in an east and west direction and extends from near Suffolk, Va., southward for a distance of approximately 35 miles. The southern part of the swamp is irregular and not well defined, there being interpersed low firm land with peat bogs. This area is pretty well timbered, and a larger proportion of the area can be drained and will make good agricultural lands.

Between the southern boundary of the Dismal Swamp and Albemarle Sound there are many small areas of swamp covering from a hundred to several thousand acres, most of which will make good agricultural land when drained.

The land lying south of Albemarle Sound and north of Pamlico River and Pamlico Sound is a nearly compact swamp area, 60 miles long in an east and west direction and 30 to 40 miles in a north and south direction. There are a few narrow strips of low firm land in different parts of this area, which have been cultivated for over a hundred years, and illustrate the great fertility and productiveness of the soil. This swamp area is largely timbered, and there are small areas of the open pocosin. It covers a large portion of Washington, Tyrrell, Dare, Hyde, and Beaufort Counties. South of Pamlico River, this swamp is of considerable area, with bogs in a large part of Pamlico County, and lies between the Pamlico and Neuss Rivers. South of the Neuss River and extending to the South Carolina line are swamps comprising about one-fourth of the area. These are not continuous and include such swamps as White Oak, Holly Shelter, Angola Bay Swamps, etc.

The agricultural value of these swamp lands has been known and appreciated by the people of the State for a great many years, and long before the Civil War attempts were made to drain certain of the smaller swamp areas, and also some of the swamp areas of the third class. Some of this work was successful, but most of it was only partly so; and attempts to

drain any of the swamp areas on a large scale were unsuccessful. Three obstacles formerly stood in the way of the drainage of the swamp lands:

1. Cost of clearing the land.
2. Excessive cost of digging adequate canal ditches to take care of the water.
3. Lack of adequate loans that would permit carrying out the drainage.

All of these obstacles have been removed and it is possible to drain successfully any land that has sufficient agricultural value.

The drainage act passed by the general assembly of North Carolina of 1909 and amended in 1911 makes it possible to carry out any drainage proposition, no matter how large or how many counties it may embrace. In eastern North Carolina there are now 40 districts of swamp areas organized or in process of organization. The names of these districts, the approximate acreage, and their present condition are given below:

Drainage Districts in Swamp Areas.

Name of District	County	No. of Acres	Progress of District.
Broad Creek Drainage Dist...	Beaufort	....	Completed.
Conaby Creek Drainage Dist.	Beaufort	27,000	Organized and at work.
Pantego Drainage District...	Beaufort and Hyde..	30,000	Completed.
Pungo River Drainage District, No. 1................	Beaufort	27,000	Organized and at work.
Buckle Swamp Drainage Dist.	Bladen	1,222	Organized.
Turnbull Swamp Drainage District	Bladen	3,000	Petitioned for.
White Marsh Drainage Dist..	Bladen	....	Fallen through.
White Oak Swamp Drainage District	Bladen	....	Petitioned for.
Cape Fear River and Lyon Swamp Drainage District..	Bladen and Pender	18,000	Completed. (Cost $43,577).
Old Rice Lands Cotton Plantation	Brunswick ..	17,400	Petitioned for.
Camden Run Drainage Dist..	Camden and Currituck .	24,000	Final report made.
Run Swamp Drainage District	Camden and Currituck..	18,000	Petitioned for.
Bear Swamp Drainage Dist..	Chowan	5,000	Completed.
Chadbourn Drainage District.	Columbus ...	7,300	Completed. (Cost $7,593.60).
Clay, Red Swamp and Swift Creek Drainage District....	Craven	....	Petitioned for.
Dover Drainage District......	Craven	9,000	Organized and dredges at work.
Mosely Creek Drainage Dist..	Craven	10,000	Organized and at work.
Flea Hill Drainage District..	Cumberland	20,425	Final report made (Cost $78,492).
Suggs Creek Drainage Dist...	Cumberland	3,000	Petitioned for.
Moyock Drainage Dist. No. 1.	Currituck ...	14,000	Final report made.
Maxwell, Elder and Stockinghead Creeks Drainage Dist.	Duplin	2,500	Petitioned for.

Name of District	County	No. of Acres	Progress of District.
Muddy Creek Drainage Dist..	Duplin	1,925	Organized.
Deep Creek Drainage District No. 1	Edgecombe & Halifax ...	6,300	Petitioned for.
Beaver Dam Drainage District	Harnett	7,500	Final report made. (Cost $16,065).
Juniper Bay Drainage District	Hyde	7,000	Completed.
Mattamuskeet Lake Drainage District No. 1.............	Hyde	115,000	Completed.
Abandoned Rice Lands.......	New Hanover	414	Petitioned for.
Angola Bay Drainage District	Pender	14,700	Petitioned for.
Rocky Point Drainage Dist...	Pender	7,000	Petitioned for.
Parkhill Drainage Dist. No. 1.	Perquimans .		Completed.
Deep Creek Drainage Dist...	Pitt		Fallen through.
Little Contentnea Creek Drainage District	Pitt	8,000	Fallen through.
Back Swamp and Jacob Swamp Drainage District..	Robeson	35,000	Completed. (Cost $142,621).
Hog Swamp Drainage Dist...	Robeson	15,000	Petitioned for.
Little Coharie Drainage Dist.	Sampson	3,300	Final report made.
Creswell Drainage Dist.......	Washington.		Not yet organized.
Lake Phelps Drainage Dist...	Washington. and Tyrell..	75,000	Final report made.
Wayne County Drainage District, No. 1................	Wayne	2,600	Completed.
Toisnot Drainage District....	Wilson	2,200	Organized and at work.
Wilson County Drainage District, No. 2...............	Wilson		Petitioned for.
Big Coharie Drainage Dist...	Sampson		Petitioned for.
Big Long Creek & Tributaries			Petitioned for.

The North Carolina drainage law is just as applicable to the drainage of overflowed land in the Piedmont section of the State, and the following 20 districts have been organized or are in the process of organization:

Name of District	County	No. of Acres	Progress of District.
Brown Creek Drainage Dist..	Anson	7,500	Not yet organized.
Silver Creek Drainage Dist...	Burke	1,400	Petitioned for.
Lower Creek Drainage Dist..	Caldwell & Burke	3,000	Completed.
Buffalo Creek Drainage Dist.	Cleveland ...	1,800	Final report made.
Middle Fork of Muddy Creek Drainage District	Forsyth	550	Completed.
Muddy Creek and Mill Creek Drainage District	Forsyth		Completed.
Crowder's Creek Drainage District	Gaston	1,200	Completed.
Dutchman's Creek Drainage District	Gaston	1,000	Completed.
Long Creek Drainage Dist...	Gaston	1,200	Completed.
Horsepen Creek Drainage Dis.	Guilford		Petitioned for.
Reedy Fork and Haw River Drainage District	Guilford & Rockingh'm	176,000	Petitioned for.
Falls-Byers Creek Drainage District	Iredell		Petitioned for.
Fourth Creek Drainage Dist..	Iredell		Completed.
Third Creek Drainage Dist...	Iredell	48,000	Completed.
Indian Creek Drainage Dist..	Lincoln		Organized.
Clark's Creek Drainage Dist.	Lincoln and Catawba...	2,400	Completed.
Potts Creek Drainage District	Lincoln and Catawba ..		Petitioned for.
McLendon's Creek Drainage District	Moore	1,500	Petitioned for.
Mecklenburg Drainage Dist..	Mecklenb'g .		Completed.
Haw River Drainage Dist....	Rockingh'm .		Petitioned for.
Third Creek Drainage Dist...	Rowan		Petitioned for.

The State survey has had the hearty co-operation of the Office of Drainage Investigations of the United States Department of Agriculture, and that office has carried on many investigations in the State during the past two years. This work has consisted principally in the examination of various swamp and overflowed areas, as to their being practical projects.

The fertility of the soil of these reclaimed swamp lands is unsurpassed, and sufficient work has already been done to demonstrate that this land is pre-eminently a corn soil. At the present time North Carolina produces 2.7 per cent of the entire corn crop of the United States; but, if these swamp lands were thoroughly drained and properly cultivated, they alone could produce a corn crop that would be equal to that raised in the entire United States during the past year.

After the canals and laterals have been dug, the land is cleared by cutting down the trees and underbrush and burned over, nothing but the larger rocks and stumps being left. The stumps rot quickly in this rich soil so that no effort is made, in most cases, to remove the stumps except as they decay. Even the first year after the canals have been made and the trees and brush burned, the land is planted with corn by means of a hand drill made of a piece of hollow gum wood. There is no opportunity of plowing the field, so that the corn is planted by simply running the drill into the ground and dropping the seed. On account of the stumps, the corn cannot be cultivated while it is growing. The fires, however, have destroyed all of the undergrowth and weeds, so that there is nothing to interfere with the growth of the corn. Land planted in this way has produced an average of 40 to 50 bushels of corn to the acre, a yield that gives an idea of the great value of this land for corn. As these lands are reclaimed it is not an uncommon event to see corn on land that five months before was in standing timber and brush.

Another result of the drainage of the swamp land is the general betterment of the health conditions of the section, and also a system of good roads. In connection with digging canals, if a little care is exercised, good roads along the banks can be provided. The roads involve little increase in the cost of construction.

Peat Fertilizer Filler. The demand for this material is reported brisk at somewhat higher average prices than in the past few years. As most of the factories for making the peat filler have gone out of business for one cause or another, those which have weathered the hard times should have a prosperous season, weather permitting.

FOSSILS FROM PEAT BEDS.

By Dr. O. P. Hay, United States National Museum, Washington, D. C.

Persons engaged in working deposits of peat or in draining swamp lands are in a position to make important contributions to a knowledge of the kinds of animals that lived before historic times. Even persons without any knowledge of geology are curious to know something about animal remains found in such places, but this curiosity is not well directed when the finders break to pieces bones and skulls in order to see what is inside, or when the parts of a skeleton are parceled among the friends of the finder.

It seems quite certain that more kinds of animals lived in our country during what is called the Pleistocene than lived here when Columbus arrived. Probably all those that lived here at the discovery of America lived during some part of Pleistocene, but there were others that are now extinct. Among these are mastodons, elephants (often called mammoths), several species of bisons, musk-oxen, deer, moose, peccaries, tapirs, horses and gigantic slothlike brutes, common beavers and another species much larger, wolves, foxes, and bears. Skulls, teeth, bones, and some whole or nearly whole skeletons or these may be found.

Besides the animals mentioned a multitude of smaller animals must have lived in these swamps and left their bones buried in the peat and muck. Such bones and skulls, and even single teeth, ought to be preserved and deposited where men who study such things can get at them. A single minute tooth might tell of the former existence of some strange mouse or squirrel.

When animal remains are found a label ought to be put with them or on them showing exactly where they were discovered, at what depth, and in what kind of soil. A specimen without a statement of the locality where found is of little value. Again, when a bone or several of them together are found, care should be taken to injure them as little as possible and to obtain every bone and every fragment broken off. What can we say about the man who, having found a fine bison skull, smashes that skull and saves only the horns, or who breaks up a mastodon skull to get the teeth? Yet such things have been done.

A word as to the disposal of specimens. The museums need these things, but they are not rich. Persons who are generous enough to give the objects discovered receive ac-

knowledgement for their gifts. If the finder thinks he ought to receive something for his discovery let him be reasonable. A single mastodon tooth is not worth a thousand dollars; probably the complete skeleton would not bring so much. The idea ought to come to each finder that he has an opportunity to contribute something to human knowledge.

Among the fossils most commonly found in making excavations in marshes are teeth and jaws of mastodons and elephants. The two are often confounded. The teeth of elephants (mammoths) are composed of thin plates, varying in number according to the age of the animal. The plates are placed face to face and appear on the side of the tooth as ridges running from the root to the grinding surface. The latter is crossed by ridges, which are the worn edges of the plates. The first tooth of the baby elephant will have only 4 plates, the last or sixth tooth in each jaw may have 24 or even a few more such plates. Figure 1 shows a side view of an elephant tooth; figure 2 shows a view of the grinding surface of the same tooth.

Figure 1. Tooth of elephant **(elephas columbi)**, side view.

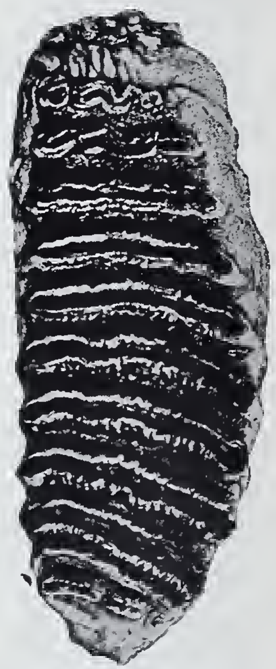

Figure 2. Tooth of elephant **(elephas columbi)**, grinding surface.

A mastodon's tooth has a crown which when worn shows two to five cross ridges, each composed of two cones. Most of the teeth have either three or four cross ridges. The last tooth of each jaw may reach a length of 5 or even 8 inches. Figure 3 shows a side view of the crown of a last lower tooth that had not yet been cut and had not yet devel-

Figure 3. Tooth of mastodon, side view.

Figure 4. Next to last upper tooth of mastodon, grinding surface.

oped its roots. Figure 4 shows the fourth upper tooth. This had three cross ridges and these had all been somewhat worn down, the front ridge most of all.

Lately Mr. John Wiedmer sent to the National Museum from a peat deposit at Manito, Ill., the skull of a species of extinct musk-ox. This species called the **symbos cavifrons,** has been found in a considerable number of places and it probably

Figure 5. Skull of extinct musk-ox **(symbos cavifrons).**

lived within the United States when the last ice sheet yet covered a part of our northern States. Figure 5 shows a face view of the skull.

Figure 6 presents a view of the skull of an extinct species of bison. This was found near Vincennes, Indiana. It will be seen that in the musk-ox the horns turn downward and forward at the side of the face, whereas in the bison (Fig. 6) they are directed upward and backward.

Figure 6. Skull of extinct bison.

But these are only a few of the interesting animals that are to be found here and there throughout our land.

LITTER-GRASS MEADOWS ON THE MOOR.

(Translated from H. Schreiber's Article, Oesterr Moorzeitschrift, 1913.)

The same types of herbage will thrive, by proper drainage, fertilizing, etc., on the different classes of peat deposits (mossy, boggy, or swampy); therefore general rules can be drawn up for the cultivation of all peat deposits. With litter meadows it is different, as here it is the rule that the original plant which grows on and composed the deposit is favored.

The following qualifications show where litter-grass meadows differ from fodder meadows:

(1) They must not be drained, as a large quantity of vegetable material can be obtained only by the presence of large quantities of soil moisture. An especially favorable con-

dition is effected by having the meadow temporarily under water, or better still, under running water. It is, however, desirable to have the surface water drained off at mowing time.

(2) In general they should not be fertilized. By fertilizing, the sweet grasses are benefited; these make poor litter-grass plants, inasmuch as they have less mass and produce soft and brittle bedding.

(3) The litter-grass meadow must be mowed only in the fall, as litter-grass plants become larger by longer growing, dry easier in the overripe condition, and the subterranean root system collects more nourishment for the next season, than if cut down early.

These three fundamental rules, which save money and time, appear favorable for the cultivation of litter-grass meadows, although the gathering in the late autumn falls at a poor working time. Litter-grass meadows are cultivated when the following conditions exist:

(1) When a large peat deposit has to be cultivated, i. e., when the deposit is so big that there is lack of labor and money to turn it into arable land or, on the other hand, when it is too moist for planting trees.

(2) When the demand for stock bedding is large and the supply hard to obtain. It would appear that peat litter should take the place of litter grass, but this is not the case, as not every kind of peat can be used as peat litter, and many of those peat deposits that are best for growing litter grass show a black, well-rotted peat, which forms a black, mushy mass under the animals' feet, or, in other words, forms a poor litter.

(3) In all cases where the drainage of bogs does not appear practicable, in cases where the water level cannot be well lowered, or where deposits covered with water, on account of weirs or dams, exclude the development of arable or wood land.

(4) Deposits from which the peat has been taken away, and on account of lack of money or other reason cannot be properly cultivated, yet should return a revenue.

Anyway, good returns can be obtained by a small outlay of capital, provided the litter grass is properly looked after and the deposit is well situated. Of course the value of the litter grass is greatest in places where cattle rearing is largest and where the production of fodder is small or where weather conditions necessitate lengthy barn feeding. Prof. Stebler states that in Switzerland 40 to 60 cents per 100 pounds is obtained as the price for this litter grass, and as a yield of 10,000 to 16,000 pounds is obtained per acre, a nice income is procured and at the same time the value of the property is increased.

Statistics are hard to find and figures given in old publications are unreliable. The only authoritative ones of value are given by Stebler for the amount of litter grown on peat deposits in the Canton of Zurich, Switzerland. In 1892, 700,000,000 pounds of such straw was obtained, representing a value of nearly $300,000.

Litter-Grass Meadows of the Reed Moors.

The utilization of reed moors many of which are surrounded with peat moss, is rather ancient in the Alps. Reed, sedge grass, and blue grasses, which are not good for feeding material but are good straw formers, are especially well adapted for such soils and grow without draining, fertilizing, or much attention.

Reeds.—The reed is in general more productive the wetter the soil. If the amount is very large two cuts can be taken. At first the reed is mowed on reaching half its height, and in late autumn the remainder is mowed. The production of dry straw is very high and is supposed to reach as high as 13,000 pounds per acre. However, reeds do not produce bedding of the best quality. It is somewhat hard and rots slowly. The absorbability is slightly less than with ordinary straw. The ash of the reed straws shows a very high silica content (up to 77 per cent of the ash). The reed litter is cheaper than either sedge-grass straw or blue-grass straw.

The planting of reeds is recommended for the following purposes: (a) To utilize old river beds, peat holes, or ponds that cannot be drained; (b) to protect shores or banks; (c) to provide abodes for birds.

The planting of the reeds is done best by setting out rootstocks in March and April. The hole is dug about 1 foot wide and the root is put in place where there is still water. The planting must not be done too late, as it is necessary that the water should rise before the plant starts to grow. (The lowest water level of the lakes, etc., is always in the winter.)

Delius (1874) recommends the taking of 5-foot stalks and placing them in wind-protected muddy places. The roots will form then, and they may be transplanted in autumn to the place desired.

Sedge Grasses.—Most of the sedge grasses are good litter plants. Dried litter from a sedge grass will take up 300 per cent of water, and in this respect comes near to wheat straw. In most cases sedge-grass litter is not hard and decomposes easily and equally. To increase the production of sedge-grass litter, it is necessary to have the soil wet; in fact, it is well to occasionally allow the water to entirely cover the sedge grass. In reed moors, fortunately, this is easy. In the Alps water is

allowed to cover the sedge grass about one and a half days in every seven.

If the grass is mowed when the leaves begin to turn yellow, at which time enough nutrition for the next season is stored in the roots, then the growth of sedge grass in the following year is very luxuriant.

The planting of sedge-grass seeds is exceptional, as they can not easily be obtained in commerce. However, in cases where the seed is planted it is of considerable importance to keep the soil moist all the time and to prevent weeds growing in the soil. The plants reach final development only in the third year. The sedge grasses seed only sparingly. The seeds fall off easily and germinate slowly, so that to obtain slips for replanting it pays to sow only on a small scale.

Quicker and more successful cultivation is obtained by planting slips in peat deposits. The stems taken in the spring are divided. This is easy, where there are isolated shoots, but somewhat difficult where the plants are growing densely. However, success can be obtained if there are root stocks with buds. The planting is done in rows about 3 feet apart, full development generally being achieved in three years. The planting is done as follows: A man turns up the ground with a hoe and a second man pushes in the slip; then the first man presses the soil back again.

Climatic conditions are frequently overlooked, but sedge grasses thrive best in the warmer locations at low altitudes, whilst reeds that grow on peaty soil will thrive in higher altitudes.

Blue-Grass Litter. Blue-grass is one of the best litter grasses and furnishes an important part of the litter of the Austrian and Swiss Alps. Blue grass will grow in any soil, provided the soil contains enough moisture, but thrives best of all in fresh clayey soil, when not in too high altitudes, and second in peat soils. In higher altitudes the blue grass does not grow high and seldom reaches the mature stage. It does not develop well and the production is so small that its cultivation does not pay. In the Sudetic Mountains (Austria) above 2,600 feet and in the Alps generally above 3,300 feet it attains only about 20 inches in height, whilst in the lowlands it reaches as high as 80 inches. Some blue grasses are found in higher parts of the mountains, but are generally limited to mineral soils.

The mowing should take place when the leaves stop growing. By mowing too early the culm retains too little nutritive material, a result that weakens the next spring's growth. The seeds that fall off sprout the following year, so that the blue-grass stock becomes continually denser.

According to Stebler, the product from good blue-grass meadows in the Canton Lucern is 5,000 to 10,000 pounds of dry litter per acre. To obtain the seeds, the panicles with the ripe seeds are cut off with a sickle, tied in bundles, and when properly dry are taken home and thrashed out. The seed, whose germinating power is not very great, must be frequently turned over while drying. One acre often produces 350 pounds of seeds, and one gallon of seeds weighs slightly over 3 pounds.

In sowing blue-grass seeds a well-worked and well-weeded plain is used, and the seeds are planted as soon as the snow has melted. The development is very slow; in the first year a gemma is formed, panicles, indicating maturity, forming generally in the fourth year. Should the field contain many weeds, the blue-grass reeds may be easily stifled. A yield can be expected only in the third year, the yield increasing every year until about the seventh, when the yield remains approximately constant. Should a yield be desired in the first year it is advisable to mix the blue-grass reed seed with half as much reed canary grass. Reed canary grass develops very quickly and its growth is retarded after late cutting if the soil is not fertilized, so that it gradually disappears and finally leaves only the blue-grass, which continually becomes denser. If any blue-grass reeds exist in a moist field, they can be strengthened by late mowing, whilst the other plants will be retarded. On the other hand, a blue-grass meadow can be converted to a fodder meadow by drainage, fertilizing, and early mowing.

Litter meadows are not so easy to start as fodder meadows for the following reasons: (1) There are very few seeds of the litter-grasses in the market; (2) the seeds of the litter grasses, especially the sedge grasses, show small germinating power; (3) the best litter grasses develop slowly and are therefore easily stifled in their first year by quick-growing plants; (4) at present only little experience is obtainable in this line.

The planting of a litter-grass meadow requires a weeded peat soil and the use of a desirable mixture of seeds. One of the best seeds to mix in with the litter-grass seeds is that of the reed canary grass. It has been used as a litter plant with considerable success during the past two decades. Its water-absorbing power is somewhat greater than that of ordinary straw. The sowing should be done on a fresh or moist loose soil, but it may be sowed on almost any soils provided they are well irrigated and in a warm climate. To prepare a meadow for reed canary grass, it has to be plowed and harrowed. The plant develops very slowly and reaches full development only

after four years. Young plants are cut only in September, older ones twice a year. The seeds become ripe towards the end of July or beginning of August.

To obtain the seeds the panicles are cut off with a sickle, dried, and the seeds thrashed out. About 175 pounds of seed per acre and about 9,000 pounds of litter per acre are obtained. After one or two years meadows that have been started by sowing seed should have slips introduced in the poorer places, slips from wild reeds in the neighboring bogs being especially desirable.

The hay from the litter-grass meadows can, in cases of emergency, be used as fodder. Horned cattle must not be given sedge grasses, but horses can eat such grasses with impunity. Meadows that are to be used for pasturing horses are drained, used as pasture in the spring, then left till the end of summer, when they are mowed and thrown open for pasture again in the autumn. By this method the fodder plants are favored against the litter-grass plants, and in a few years the plant condition is a totally different one than if only litter grasses are grown and the meadow remains undrained. Hay meadows should be slightly fertilized every once in a while.

The conversion of a litter-grass meadow to a fodder meadow can be effected slowly by drainage, fertilizing, and early cutting, or quickly by plowing up the litter-plant turf in the autumn and sowing a fodder grass-seed mixture in the spring.

The conversion of a poor fodder meadow to a good litter meadow may be done by continual late cutting, ceasing to fertilize, keeping the meadow moist, irrigating in the spring and early summer, and planting slips of good litter-grass.

Litter-Grass Meadows of the Moss-Peat Deposits.

Although the reed moors are natural beds for litter grass, on moss peat deposits this is only exceptionally the case. In cases where the moss-peat deposit is far above the sea level, the litter plants are small and generally hard and woody because the available heat for the growing plants is less; the decomposition of the peat (and therefore the content of soluble nutritive material), as in typical reed moors, where flowing water exists, is also less. Finally the moisture in such moors is derived only from rainfall and does not contain nutritive material in solution.

As the litter grasses to be desirable must be tall and tough but not coarse, there are few of the litter grasses obtained from moss-peat deposits. A few that may be considered are: Grasses of the family Cyperaceae, the sedges, such as cotton grass, turf rush, etc., which are hard to mow and do not make a dense growth.

Some grass-like plants belonging to the family Juncaceae or rushes, as the small-leaf cotton grass and white rush, are also plants of small size and weight. There still remain the sedge grasses, which are not found in general on moss-peat deposits, but occasionally grow in the ponds or very wet places in them, but they are small compared to the growth on reed moors. The cultivation of sedge grasses on moss peat is difficult, as the seeds germinate poorly and are not obtainable in the market. In addition to the above, moss-peat deposits are hard to irrigate, as the ditches easily fill up so that water has eventually only a limited flow.

Blue-grass is the only litter plant that grows excellently in mossy peat. The reed canary grass, the seeds of which are found in commerce, also grows well in mossy peat, but for good results fertilizers must be used.

At higher levels, 3,000 feet or more above the sea, it does not pay to grow blue-grass litter. Happily, it is not necessary there as mossy peat forms an excellent litter material. It is advisable to cut the moss peat and to produce litter material from that. The meadow thus formed should not then be allowed to grow wild, but should be cultivated as a pasture meadow, or, at less cost, for the production of hay. In this case, as we have seen before, a slight fertilizing is necessary, the seeds do not cost much and the yield, even if not great, is acceptable. If no cultivation is given such land the original peat plants will again grow there. These are of no use and greatly obstruct a later cultivation.

Weeds of Litter Grasses and Their Extermination.

Good litter grasses grow tall, are tough but not coarse, are ripe at the mowing time, and have considerable weight. All other plants are considered weeds to the straw grasses. To these belong the following:

(1) Louse-wort, foreign seeds, etc., which grow as parasites on the roots of the grasses. With a little effort these can be exterminated.

(2) Perennial herbs, which have thick and hard stalks at mowing time, whilst the big and numerous leaves generally fall to powder. These perennial herbs are hard to fight. Should they appear only locally on the meadow, the best thing to do is to cut that part of the turf away and replant it in the spring. Dry parts of the meadow should be dug away and used to fill in some of the low places. Especially dangerous weeds, such as thistles, should be cut at blossoming time; at least they should be prevented from blossoming. The same holds good for all plants, that produce seeds at the mowing time and as

the seeds appear in the litter and later in the manure, in which they are taken into cultivated weedless meadows. With good litter grasses, however, there is little to fear in this regard, as they grow only in very wet places and the mowing time is so late that the seeds of the weeds have generally fallen out already.

(3) Woody plants, such as trees and bushes. These can be exterminated by rooting out.

(4) Mosses. Under certain conditions moss keeps the litter grasses back, yet the moss itself can be used as a litter plant, but it produces a very small dried mass. In such cases the moss should be raked off the deposit, dried and used as litter. The weeds are especially dangerous when they are poisonous, affected by fungus, or thorny. They are easy means of creating disease in the litter grasses.

Harvest and Use of Reed Litter.

The harvesting takes place in the latter part of the autumn and the reeds are cut with a scythe. By preventing the water flow and allowing drainage, a dry and straw-like blade is obtained in comparatively quick time. The dried grasses are stacked around a smooth pole in a dry and easily reached place, the stack being made larger in diameter at the top than at the bottom. The long grass is chopped like straw before using it as bedding, so that it can be easily distributed about the stall. To economize, only the parts saturated with the excrements are renewed daily, and a corresponding amount of fresh litter is added and spread evenly in the sand, or on the floor of the stables.

Errors That Are Made on the Meadows.

Following is a brief summary of errors made on the meadows:

(1) The field is not properly leveled; the dry points yield poor litter and the low places present offer difficulties in making the crop.

(2) Insufficient moisture is supplied by irrigation.

(3) The weeds are neglected.

(4) There is a failure to add slips of good kinds of plants to improve the crop.

It should again be remarked that the production and growing of the seeds, of good litter grasses, especially blue-grass seeds, greatly improve the crops.

PEAT, BOTH FUEL AND FERTILIZER.

By J. L. Hills.

(From the Commercial Fertilizer for April, 1913.)

Peat has been used as a fuel for centuries. Roman writers cite its use two thousand years ago, it has been Ireland's main supply for many centuries, and the poorer folk of North Europe in general have always largely used it and still continue so to do. It is employed on the Continent, both for domestic and for power purposes. Every European country in the peat belt is yearly increasing its output of peat fuel. New processes for its utilization are being developed and there are several experiment stations in northern Europe whose sole reason for existence is peat study. Canada, "Our Lady of the Snows," burns much fuel. Her available coal supplies are not plenty, but her peat beds are extensive and well distributed. Hence in certain sections of Ontario and Quebec much attention has been paid to peat-fuel production. Some of this has been used in gas producers and gas engines to good advantage, but no great commercial successes have been recorded.

Prior to the general use of coal, peat-fuel usage was not uncommon in New England, the deposits being locally consumed. Some interest was evinced in a commercial way in the sixties but no success was attained, and nothing more was done for the forty years prior to the coal strike of ten years ago. Since that time, however, much effort has been expended and large sums employed in the attempt to commercialize peat fuel. Some of these enterprises are still under way, and benefiting by the errors of their predecessors, seem more likely to succeed. But when all is said it cannot be gainsaid that there is less need of peat fuel in this land of anthracite and bituminous coal, of natural gas and petroleum, than in countries less well blessed. Yet the peat beds of this country are great latent resources of fuel which are lying unused, which some day may be of service. Peat makes a good fuel, not an ideal, but a good one.

The water content of peat has bearing on its fuel value. It may carry 90 per cent when dug and when dried usually contains fully 25 per cent water, which replaces an equivalent weight of combustible matter. Not only are production costs increased by its presence, but large amounts of heat are wasted, as far as economic uses are concerned, in its evaporation. Dried peats, moreover, absorb water readily from air, so that this is always a factor, and a variable one at that, to be reckoned with.

The peat and muck deposits of the United States form one of its latent and practically undeveloped resources. They stand in no need of "conservation," they call for exploitation. They are worthy of attention. Private enterprises in this and other countries have expended large sums in the industry. Broadly speaking, however, the deposits as a whole have been neglected in favor of coal, wood and gas as fuels, and of barnyard manure or commercials as fertilizers.

Many sandy sections of this country include considerable marsh lands which are largely composed of 2½ to 3½ per cent of nitrogen and even in a partially dried condition contain as much nitrogen as does good barnyard manure. It is true that this peat decomposes slowly in the soil and that large applications of it must be made at first. Muck or peat has been used as a fertilizer in various countries for hundreds of years, but in order to definitely determine its value under the conditions in our own country, a study of its use has been made by various States. The result of a four-year test in Wisconsin is briefly given. Since the peat contains very little phosphorus and potassium, it was necessary to add fertilizers containing these elements.

In these experiments 25 loads per acre of peat of a low grade, supplemented by 100 pounds of muriate of potash and 200 pounds of acid phosphate, have been compared with barnyard manure at the rate of 15 loads per acre.

Plot to which peat, phosphate, and potash were applied, 17.7 bushels per acre.

Plot to which manure was applied, 27.2 bushels per acre.

While this average shows a much larger yield on the plot to which manure was applied, the last crop of the four was 28.5 bushels on the plot with peat treatment and 25.3 bushels on the plot with manure treatment. In other words, there has been an increase in fertility on the plot to which peat was applied, while the yields on the manured plot have shown no corresponding increase.

Where peat in a partially dried condition is available at a moderate distance, it can be used effectually to increase the nitrogen and organic matter of the soil but it must be supplemented with phosphate and potash fertilizers. Many of the marshes which are scattered over the sandy section of the State are being ditched for drainage purposes and partially dried peat is readily available in large quantities under such conditions.

PEAT FOR PAPERMAKING.

(From Pulp and Paper Magazine for April 15, 1913.)

A report on "The Investigation of Peat Bogs and the Peat Industry of Canada," by A. Anrep, the peat expert of the Dominion Government, is off the press. Dealing with peat as a papermaking material, the report quotes from a report of Emil Hazulund as follows:

The question of manufacturing paper out of peat, especially out of unhumified sphagnum moss, has been raised many times. The inquiry has usually ended, however, with some small experiments. Scientific men in the paper industry do not seem to have had very much confidence in the results of these experiments; and this lack of confidence as will be shown was well founded.

The consistency of peat is such that, it cannot be expected to make strong and durable paper without the employment in its manufacture of complicated and extensive machinery necessary for the cleaning, bleaching, and drying of the peat. This makes the finished product so expensive that it can hardly compete with the prices of the material now on the market.

At the Mosskulturforeining (Swedish Peat Society) museum is to be found a considerable collection of peat-paper samples from different places. Some time ago several samples made from Irish peat were added. Comparison of these samples with those previously collected caused an investigation to be made to ascertain whether they were made of peat.

Some of the tests of the strength of paper hereafter mentioned have been made according to the American standard by Engineer A. Skeppstedt at the Munksjo paper works—to whom I am indebted, and have to thank, for valuable written information. Several historical abstracts concerning foreign manufacturing have been taken from "Osterr Moorzeitschrift." Herr Schreiber for many years gave short accounts of the different paper manufacturing firms and processes. Careful note was made of the length of time each firm lasted before going into bankruptcy, and of the losses entailed in each case.

(I) Pasteboard, manufactured at the Munksjo paper works in 1890, for experimental purposes, proved to be very loose, slightly glazed, thin, and golden brown in color with dark stripes. Thinner paper was also produced. It had a tensile strength of about 15 English pounds, weighed 190 grams per square meter, and was 0.32 mm. thick.

Microscopic investigations. The main part of the material consists of unhumified perfectly hyaline (glass-like) sphagnum

moss. The leaves are unfractured, and show, occasionally, distinct pores; but with a dissolved glass-clear substance. The stems are often quite long, and extend right across the field of view at 80 times enlargement. The woody texture in these is whole, but the bark may be lacking. However, there is to be found perfect bark structures with distinct retort shaped absorption cells.

Eriophorum vaginatum appears in dark strips up to 1 centimeter long, 0.1-0.8 mm. wide. This, at the enlargement seems to consist of bast elements from leaf sheaths. It is also found with brown striped bast threads, and between these hyaline (glass-like) epidermis cells; fine roots of carex occasionally occur. Fibers of spruce, sphagnum, spores, and spruce pollen, are found in small quantities.

It can readily be seen that pasteboard of the above quality cannot possess much strength. The leaves and stems of the sphagnum mosses contain very little of the thread or bast elements which are required for manufacturing paper. The filtering capacity of the leaves is extremely small, and decreases as they disintegrate. Even the stems which contain wood substance have a small quantity of fiber. The wood substance is composed of only a few cells and thick layers of weak and short wood cells with little substance. Inwardly the stem assumes the texture of pith and outwardly of bark (airbags).

The binding elements in this case are the added wooden substances and eriophorum, while the sphagnum can only be considered as a filler, and as such, it is for most purposes unsuitable.

(II) Pasteboard from Lindefor's paper factory is almost straw-color and consists of different thicknesses—from 0.39 mm. to over 2.0 mm. The weight of the first-mentioned thickness is 300 grains per square meter and contains, according to the statements issued by the factory, 40 per cent sphagnum moss and 60 per cent woody substance.

The sphagnum moss consists mostly of absolutely unhumified hyaline leaves of different varieties, with a small amount of stems. These retain the bark texture while the leaves are generally whole. Eriophorum vaginatum is less frequent.

As in the previous case, the sphagnum moss is little disintegrated, but on account of the large quantity of added wood fibers, it possesses greater strength. It is impossible to see the peat in the pasteboard with the naked eye; this can be distinguished only after microscopic investigation. It is noteworthy that the paper is of a light-yellow color; foreign peat paper is always of a dark color.

It may seem from the above data that the results of these tests were successful. However, owing to the great capacity which peat has for absorbing water, and the great expense entailed in removing the same, the experiments were not continued. This pasteboard was manufactured according to Dr. Beddie's patent in Berlin.

The process is as follows: The raw peat is cleaned, first by mixing it in the machine with a weak solution of alcohol for removing the humus substance; it is then disintegrated in specially constructed machines and finally in most cases bleached. The bleaching process, it is claimed, is very difficult and costly—much more so than in the case of wood fiber. Hence it has been shown that sphagnum moss, even with the addition of a large amount of wood fiber, can not be used economically in the manufacture of paper.

Pasteboard manufactured by Engineer Ludwig Franz in Admont, Steiermark, is of a dark, gray-brown color, and is of several thicknesses. The thinnest quality had a tensile strength of 40 English pounds, weighed 400 grams per square meter, and was 0.54 mm. thick. Pasteboard 2.05 mm. thick had a tensile strength of 130 English pounds.

A. Cardboard: The surface is covered with minute fibers, which are not visible to the naked eye. The quantity of peat added is, in comparison, the same as in the Lindefors pasteboard. However, the Austrian sphagnum moss is more uneven than the Swedish; it is more humified and contains other kinds of peat residue, eriophorum vaginatum heather, and different kinds of carex. It seems that manufacturing was continued longer, which may be seen partly from the appearance of the cardboard and from the microscopic structure. Sphagnum leaves, humified to a certain degree, occur in smaller parts; unhumified pieces are often whole and hyaline (glass-like); the stems are very short and in many instances I have found the bark structure unfractured, the spirals of the absorption cells may also be very clearly noticed and even the spores of the sphagnum moss are well preserved.

Eriophorum occurs in considerable amount and occasionally may be found as single fibers, but more often several fibers are gathered together in a flat, comparatively wide streak. Between the fibers occur parts of hyaline, epidermic, wave-shaped cell walls. The impurities found consist of leaves of golden maiden-hair, "Polytrichum commune," Jungermannia and some bark cells of heather, "Colluna vulgaris"; carex is found in the form of single, fine root branches. The fibers are composed chiefly of spruce, and fragments of bark of the same

plants are to be found. The fibers are bedded in pulp consisting of pith particles.

The sphagnum moss may also in this case be considered only as a filler, while the remaining peat substances, as for instance, eriophorum, heather, and carex, contain more or less of fibrous material which contributes to the strength of the paper. Lumps without structure may be noticed, which, no doubt, originate from peat. These have no value, only making the paper dark and rendering the bleaching more difficult.

B. Pasteboard from the same place seems to be of the same composition as the above, the difference being so little that it is not worth while referring to it.

In 1902 a banker—Mr. Jellinks—and a few others, started to manufacture paper at the factory in Admont, situated high up in the Steiermarks Alps. At the beginning the work was performed in an honorable manner, but later on it was in operation only when the shareholders were expected to visit the plant. In 1904 it ended disastrously and the bank lost over a million kronor (1 krona equals 27 cents).

In 1907 Engineer Ludo Franz started the operations anew, but shortly after he also was obliged to give up.

The situation of the factory was unfortunately chosen. The bog contained too little eriophorum peat. It was calculated that the wasted peat could be used as fuel, but on account of the heavy rainfall the drying was not successful. Lignite also proved to be an expensive fuel, but it was cheaper than using peat; even the peat-litter factory employed lignite as fuel.

Thin paper, manufactured in October, 1897, by the firm, Karl A. Zschorner & Company, Vienna, contained according to printed statements, 75 per cent of peat. It had a tensile strength of 10 English pounds, had a weight of 105 grams per meter, and was 0.13 mm. thick.

The quantity of sphagnum moss is considerable, leaves mainly occur, which are usually disintegrated and dark in color. It may be noticed that the peat has not been fully humified; the particles of stems are rare, and when found the layer of bark structure is lacking.

Eriophorum occurs in a considerable amount. It is found partly as hyaline, epidermic, wavy-shaped cell walls, partly flat and sometimes in strips. The fibers are of a brownish color, and when enlarged 80 times it may be noticed that they are of a spiral shape and striped in a longitudinal direction with plainly visible cell walls at the ends.

The additional wooden substance is stated to be 25 per cent, but it seems to vary in different samples, sometimes being more. An inconsiderable quantity of pine and spruce

pollen, heather bark, leaves of mosses, and single, fine roots of carex is to be found.

Some of the paper is colored in different shades: reddish, blue-gray, brown, and yellow-brown; the two first-mentioned colors have been exposed to daylight (not sun) which made them fade on the outside.

Concerning the strength, it is, as mentioned above, only 10 English pounds, while the Munksjo pasteboard of the same weight has a strength of 60-65 English pounds. It is doubtful for what purpose this paper could be employed, as it is unsuitable for wrapping paper.

Zschorner started his manufacturing in 1895. He and two other manufacturers exhibited samples of peat paper at the World's Exhibition in Paris. Shortly after the firm became bankrupt and the two other manufacturers also failed during the same year.

Finally, I have also investigated a paper of English manufacture. The samples received here consisted of a series of postcards, partly colored and partly autotyped. The paper is loose and of the same gray-brown color as the Admont paper. For this reason, the heading stating that the paper was manufactured from the old Irish soil from peat out of the Allan bog, could easily be believed. However, despite several investigations made by me, I was unable to find any peat substance in the paper. Usually all the samples from the other manufacturers contained considerable quantities of sphagnum moss, at least some vegetable substance was shown. Wooden and cotton fibers were principally found, consequently there is no peat, either as filler or fiber. If some of the dark, structureless lumps originated from intermixed peat, it could only add to the coloring of the paper; for the rest, the heading "Peat Paper" is a fraud.

A short time ago Dr. Hallessy, of the Irish Geological Survey, stated in a letter to the Director, H. v. Beilizen, that the manufacture of peat paper was discontinued four years ago. This will explain why the addition of peat in the paper is doubtful.

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EDITORIAL NOTES.

Editorial Assistant. During the field season the Editor has turned over the detail of the editorial work on the Journal to Mr. C. T. Robertson, Box 278, Mt. Rainier, Md., to whom all matter for publication should be sent until further notice. While traveling on field duty neither time nor opportunity present themselves for any writing or critical reading; hence the necessity of the temporary change. Mr. Robertson, who has very kindly undertaken the work, has had much experience in editorial work on the staff of the Bureau of Mines, and the Journal will not suffer in his hands. Dr. Philipp still continues in his arduous duties as Exchange Editor.

The Drainage of Swamp Lands. The excellent paper that was read at the New York meeting of the Society by Dr. Joseph Hyde Pratt, State Geologist of North Carolina, and first President of this Society, is of special interest to owners of peat lands for several reasons. Dr. Pratt's State has done more than almost any other to carry out a well-planned system of drainage in a region where it was especially necessary, and this work was done with Dr. Pratt as the official head of the enterprise; hence the paper is based on large experience.

Many areas of peat land are so situated that no one individual or company could undertake to drain them, and yet to make them valuable they must be drained. Dr. Pratt's paper shows how proper laws can be secured to carry on drainage works on a large scale, besides giving many other hints that are of interest and importance.

Peat-Fuel Making. There are few types of peat that when dry are not improved by a thorough maceration. The tendency in later years, seems to have been to get large quantities of the raw peat through the pugging machine as quickly as possible, and to secure large output rather than thorough crushing. This is of small consequence with well-decomposed peat, but when the peat is fibrous or woody, lack of proper maceration makes a bulky, light-weight fuel that may also be dusty and brittle when dry. Thus the top peat in many kinds of peat deposits makes a much more inferior grade of fuel than the lower layers in the same bed, because the lower parts of the bed crush into a much finer-grained mass with the same treatment than the upper parts do. It is to be hoped that everyone making machine peat will take these facts into consideration and in selecting a machine choose one that has good macerating qualities as well as large capacity.

Classification of Peat Litter. Contrary to the usual understanding in this country, there are a number of well recognized types of peat litter besides that made from moss peat. The greater part of that imported into this country is, however, true moss peat in which the remains of the so-called peat moss, **Sphagnum,** are the most abundant and characteristic material. Dr. Tacke, of Bremen, Germany, in a recent article makes the following classification, based on the common names of the characterizing plants whose remains are the most conspicuous in the peat from which the litter is derived:

(1) **Sphagnum peat litter** (Bleichmoostorfstreu)—Peat litter made from the peatified but little decomposed remains of different species of **Sphagnum.**

(2) **Wool-grass peat litter** (Eriophorumtorfstreu), which is made from the peatified leaf bases and leaf fibers of the round cotton or wool grass, **Eriophorum vaginatum.** (In the United States this is the common cotton grass of our northern peat bogs.)

(3). **Arrow-grass peat litter** (Beisentorfstreu) consists of a preponderance of the remains of a grasslike plant, **Scheuchzeria palustris,** including the small rootlets and numerous tubercle-covered, thin, scalelike leaves inclosing the underground

stem of this species. (This plant is common in peat bogs in some sections of the United States.)

(4) **Tall reed grass peat litter** (Schiltorfstreu) consists chiefly of the peatified fibrous roots of the tall reed grass, **Phragmites communis**, stratified between layers of the flat-pressed underground stems of the same plant. (The tall reed grass is often very abundant in the United States and its remains are common in our peat beds.)

(5) **Sedge peat litter** (Seggen or Carextorfstreu) is made in the main of the peatified feltlike network of roots, underground stems, stalks and scalelike underground leaves of a species of sedge (**Carex**). (This is about the most common type of fibrous peat in the United States and it is usually present in our open marshes.)

(6) **Brown moss peat litter** (Astmoostorfstreu) consists mostly of the peatified remains of the brown mosses or branching mosses, **Hypnum**; aften this type is mixed with sedge peat by interbedding.

(7) **Other mosses,** such as commonly occur on peat bogs, sometimes form beds of partly peatified material which may make good stable litter. Among the mosses mentioned as thus forming peat suitable for litter is the common "hair-cap moss" **Polytricum,** which makes excellent growth on dry peat beds in North America.

It is thus evident that several kinds of peat, if not too much decomposed, and properly dried and shredded, will make good peat litter.

Price of Peat Moss in Holland. Consul General S. Listoe is informed that the price of peat moss packed in linen f. o. b. Rotterdam is 26s ($6.33) per metric ton (2,204.6 pounds). The freight rate to New York or Boston is 14s ($3.40) per ton.

The Relative Value of Peat Litter. In a verbal communication to the Editor, a stable keeper in Michigan who for some years had used peat litter for his horses to the exclusion of all other kinds, said he considered peat litter well worth $15 per ton, the price he was then paying for it, when he could buy wheat straw at $8 in the local market. The peat litter lasted more than twice as long and his horses' feet were in far better condition than when he had used straw. Aside from these facts he said that all objectionable odors were entirely eliminated from his stable even in the hottest summer weather.

A Remarkable Peat Machine and Process. A clipping from the Wooster (Ohio) Republican is responsible for the follow-

ing quotation from the statements of A. B. Lee: "They are talking about the natural gas giving out, and I suppose it will, but I saw a machine in Cleveland recently that will manufacture gas out of peat on a good sized scale, and make plenty of by-products. The machine is a wonder. It makes 750 pounds of charcoal, 66 pounds of sulphuric acid, 42 gallons of wood alcohol, 800 pounds of phosphate, and 19,000 cubic feet of gas out of 1 ton of peat."

It is to be hoped that no one will take statements of the character of those given above seriously enough to invest money in a "machine" for which so much is claimed, without first having both machine and process most carefully investigated by competent and reliable engineers, who are familiar with the chemistry of fuels, as well as with mechanics. How 66 pounds of sulphuric acid, 42 gallons of wood alcohol, and 800 pounds of phosphate could be derived from a ton of peat, unless they had been added to it, will need a very full explanation, for neither phosphorous nor sulphur exists in peat in quantity sufficient to warrant any statements like those quoted.

Cauliflower as a Truck Crop on Peat. Good cauliflower can be expected from good seed in peaty soil. Cauliflower, of course, likes cool weather. Every cauliflower plant in a row, as a rule does not make large heads, but the big figure offered for good stock is a big inducement. The seed is generally planted in the open early in June, and there are occasional growers who set plants out in the fields at intervals, some as soon as they are ready to set out, and some leave them in the bed for two or three weeks. In this way they are easy to grow and easy to handle. The average grower makes the mistake of leaving the seed in the rows too thick, and getting a spindling growth as a result. It pays to puddle each plant in. Packing for shipment is also an important item, and plenty of ventilation should be allowed. The main secret of cauliflower growing is careful, persistent watching of the crop and timely blanching of the heads.

Peat Lands in Ohio. Most of the counties of Ohio have some peat land, but those north of the middle of the State are richest in this class of land. Many of these peat deposits have been drained and brought under cultivation, and in general, they have proven very fertile and highly productive. Celery is probably the most important crop grown in Ohio on peat soil, and yields of 900 to 1,000 dozen good heads to the acre are reported. Onions also do well on the peat here, as elsewhere, and until last season were a favorite crop, yield-

ing excellent returns and averaging 500 bushels to the acre. Last year there was an over-production and many Ohio onion farmers lost heavily in marketing their crop. Other farm crops of a general nature, such as buckwheat, oats, potatoes, corn, and potatoes, often give large yields on peaty soil, especially when correctly fertilized. The value of such land is becoming generally known and it will generally pay any Ohio farmer who has a piece of marshy or swampy land on his farm to drain it and put it under cultivation.

Irish Peat Enterprise. Reports from Ireland seem to indicate that there is still an interest in that country in processes for making peat into fuel, in spite of the long record of failures of large enterprises of that sort. The latest is, that Theodore Franklin, of Chicago, Ill., has been giving demonstrations of his process for extracting water from peat quickly and cheaply, before a number of English and American capitalists. The process is not described, but it is reported to give a product from peat that has twice the heating power of coal, at about half the cost (in Ireland) of coal.

The result of the demonstrations is said to be the organization of a syndicate known as the Irish-American Fuel Co. No details regarding the company's officers or of the new process have yet been received.

Cucumbers on Peaty Land. The Farmer, Minnesota, published a note recently in which the growth of cucumbers on peat and the adjacent higher land is compared. The peat was 1 to 5 feet deep and had been plowed in the spring and harrowed several times before planting. The seeds were planted and treated in the same way as those on high land. On the high land there was a fairly good crop, but on the peat neither the vines nor the cucumbers did well, and most of the latter were nubbins. In addition, the vines were frozen in the latter part of August, whereas those on the high land were not frosted during the bearing season.

Peat Fuel in Vermont. John Webster, of Franklin, Vt., is reported by a Bennington paper to have made a success of preparing and using peat as fuel. His statement of the financial results is as follows: "The total expenses of preparing for fuel, including drying and stacking, or housing, were $1.14 per cord. I consider this a safe estimate. I have repeatedly done much better in good weather. I deem it worth as fuel $4.50 to $5.00 a cord. Seventy-five heaped-up bushels

make one cord which weighs a gross ton. I sold my surplus at 6 cents per bushel or $4.50 per cord, which leaves a good margin of profit."

Converting Peat Swamps Into Pastures in Germany. Recent consular reports indicate that a change of feeling is becoming manifest in Germany. It is said that the cutting of peat is now beginning to be discouraged by the authorities in parts of the country. The object is now to make pasture and farm lands of the bogs by drainage and correct later treatment. The scarcity of meat especially is causing the Government to encourage stock raising, and the land for doing this may be obtained by converting the waste peat lands into meadows and pastures. The Prussian Diet is to appropriate a large sum of money for the "betterment of moorlands." The provincial government also has a moor commission to investigate the matter and the agricultural societies are also assisting.

Fuel Briquetting in the United States (from advance chapter of Geological Survey's Mineral Resources for 1912). Briquetted fuel manufacture in the United States is passing out of the experimental stage. The production in 1912 was 220,064 short tons, valued at $952,261. Of the 19 briquetting plants operating, 7 use anthracite culm, 9 bituminous slack, 1 carbon residue from gas manufactured from oil, 1 mixed anthracite culm and bituminous, and 1 used peat. One plant at Detroit and one plant at Philadelphia, constructed for utilizing coke breeze, were not operated in 1912, the abrasive action of the coke dust being so destructive of the molds and machinery that the plants have been shut down. The quantity of raw material available for briquets is ample and obtainable at little cost. The briquetting cost is $1 to $1.25 per ton. Slack piles at many mines have sometimes been burned to prevent their cumbering the ground. The 220,064 tons of briquets made in 1912 represent but a drop taken from the bucket of available material.

Note.—The item relative to peat briquets was inadvertently inserted in the Survey's report. There were no peat briquets produced in the United States in 1912, so far as the Editor has been able to learn.

Coal-Briquet Plant in Toulon, France. The Société des Charbons Agglomérés du Littoral Méditerranéen, 46, Rue Chevalier Paul, Toulon, Var, is erecting at Toulon a large plant for manufacturing briquets, which will probably be com-

pleted next October; normal annual capacity about 200,000 tons of briquets. It is expected that the French navy and the railway companies of the district will be regular purchasers of important quantities of the output from this concern. This appears to be a good opportunity for the sale of coal-handling machinery of American manufacture.

Wisconsin Peat Deposits. The State Conservation Commission of Wisconsin report for 1912 states that it is to be expected that the marshes of that State may yield a cash return of $600 to $4,800 an acre. About 7 per cent of the total area of the State, nearly 3,000,000 acres, is marsh land. The commission states that this land may be used in three ways. It can be drained and used for agriculture; it can be held until such time as economic conditions will permit the marketing of 2,250,000 tons of finished peat fuel; or the land may be submerged and used as reservoirs for the regulation of stream flow. The commission recommended that the legislature change the present drainage laws so as to reduce the unnecessarily great expense of organizing drainage districts and that the Constitution be amended so that the State can purchase marshes and also that the State retain the large marshes it already owns, which contain clean peat suitable for fuel and other purposes.

Peat Made by Electricity. It is reported in the German papers that a chemist, Dr. Bergius, of Hanover, has succeeded in producing peat by means of laboratory experiments. Dr. Bergius has an apparatus specially constructed for this purpose, which is able to resist great pressure even at a high temperature. In this apparatus cellulose mixed with water is heated to about 240° C., the pressure exceeding 6,000 pounds per square inch. After having been subjected to this treatment, the pulp is transformed into a product the chemical constituents of which are identical with those of peat. The process is completed in 24 hours at a temperature of 350°. On this basis he says he can calculate how long was required for the formation of peat from prehistoric plants at a temperature as low as that of the earth, and the figure he has arrived at is 7,000,000 years. This figure is said to be in accordance with the calculations of geologists, who have arrived at about the same results.—The London Globe.

Peat in Brazil. In 1911 a company was at work in the state of Minas Geraes, at a place called Bom Jardin, on a deposit of lignite and peat. The peat when dry contained 7.5

per cent of ash, 8 per cent of moisture, and 62 per cent of carbon. Briquets of a good quality were then produced.

Ammonia from Peat. It was announced from Osnabrück, Germany, that on the basis of a test run of the great Schweger Moor central power plant throughout the month of December, 1912, a daily average of a thousand pounds of ammonium sulphate was recovered. This would seem to be proof that the recovery process was a success, but later reports state that the plant has been closed. It should be understood, however, that large private corporations in Germany and other parts of Europe do not publish the details of their business, and that the many rumors current in foreign periodicals relative to the future of this great peat plant are therefore probably only rumors. Judgment as to the success or failure of this enterprise and of the use of peat in the gas producer must be suspended until more authentic reports than those now current are received.

Pacific Peat Fuel Co., (Ltd.). This new company has opened offices in the Stoll Building, Sacramento, Cal. It advertises "Herbein Koal, Patented." During the past few years a number of patents for fuels having peat as a base and various materials, including crude petroleum, as binding material for making briquets have been issued to Dr. G. W. Herbein, of Seattle, Wash., but it is not known that the new company is in any way interested in any of these processes.

Indiana Peat. During the late winter the business men of Kendallville, Ind., were considering a proposition to establish a factory for making peat fuel at the rate of about 50 tons of dry fuel per day. No later report has been received and it is presumed that no plant has been started.

PERSONALS.

Our Secretary-Treasurer, in addition to his enthusiastic and tireless work for the American Peat Society, has taken numerous short week-end trips in search of peat deposits within 100 miles of New York during the spring. He reports some success in finding peat but more in finding beautiful scenery and keen enjoyment of his dinners after reaching home. If we had ten other members as enthusiastic in working for peat and the American Peat Society, as Julius Bordollo, our cause would be far in advance of its present position.

Mr. H. B. Fullerton, our fellow member, kindly made

mention of the work of our Society in the pages of the Long Island Agronomist recently. The result was to attract the attention of the many readers of the Agronomist to our existence and now we have a number of new members.

Mr. O. A. Ford, formerly of Portland, Me., has recently been granted a patent on a process for drying and briquetting peat, and expects soon to begin development.

Prof. H. C. Thompson, of the Bureau of Plant Industry, U. S. Department of Agriculture, has been appointed by the Department to take charge of the co-operative work undertaken by the bureau and the American Peat Society. The details of the work have been so far elaborated that tests on a series of crop plants suitable for peat soils are already well advanced. All of the plants tested are grown from seeds of known pedigree and under field conditions, so that results obtained will be of great value.

Mr. Karl Kleinstueck reported some weeks ago that he had started digging peat with the expectation of making fuel, but he found labor conditions in southern Michigan such that it was, at the time of his writing, very doubtful whether he would start his peat machine to macerate and brick the peat. The high price of labor and the difficulty of getting good laborers at any price is a very important item to be considered by those who plan to engage in peat-fuel making.

REVIEWS AND ABSTRACTS.

The Manufacturers' Record, on March 27 last, published, in addition to its regular weekly periodical, a large supplement entitled "The South: The Nation's Greatest Asset." The title, which is bound to rouse everybody's interest, immediately suggests the question: Is it true that the South is the Nation's greatest asset? Any one who studies the facts presented in this publication will realize the boundless potentialities stored by nature in this part of the world. Astounding as it may seem in proportion to its population, the South leads in many lines. With enterprise and industrial instinct the South will play possibly the most important part in the country's future.

The Pulp and Paper Magazine of Canada advises us that its offices and printing plant have been removed from Toronto, Ont., to the Reed Building, Montreal, Que., where all correspondence and mail should be addressed.

The question what the world will do when its coal supply is exhausted has frequently led to some interesting discussions. The question has recently been revived on account of the as-

sertion that not only the coal supply but also the oil supply of the world cannot be depended upon for long, measuring time in any sense but that of the selfish present. Among these discussions it is of interest to note that peat has not been overlooked; but its direct use as fuel in the future ages will not be considered of economic importance, as our contemporary scientific prophets predict that all but alcohol engines will be relegated to the scrap pile. The future sources for the production of alcohol will be peat, waste wood, potatoes, and other natural resources. In this respect it is of interest to note that at present there is being manufactured today, in South Carolina and Louisiana, anywhere from 5,000 to 10,000 gallons of ethyl alcohol per day, the mill waste of Southern pines forming the raw material.

The Societa per l'Utilisazzione dei Combustibili, with headquarters in Milan, Italy, has operated for about six years at Orentano (8 miles from Pontedera) an installation for the production of power from peat. About 2,000 kilowatts is provided. The operations are to be enlarged. The peat is gasified by the Mond gas process, and ammonium sulphate is obtained as a by-product. The peat is obtained from where Lake Brintina used to be.—Chem. Ztg., 1913, p. 484.

The Canadian Mining Institute is about to publish an index to Volumes 1 to 10 of the Journal of the Canadian Mining Institute. The value of an alphabetical index to any work of more than ephemeral importance is too well recognized to need insistence. The work will be in two sections, the first contains brief outlines or summaries of the several papers contributed. The second section is the index itself, with names of authors and titles of the papers. This index also contains for each entry a reference to a page in the first section of the book on which is printed a summary of the paper in question; thus the enquirer will generally be able to decide whether it will repay him to carry his research further.

English Coal Strike Causes Use of Peat. Owing to the coal strike in England and the cessation of all imports for over three weeks, local fuel dealers' stocks were rapidly depleted and it became difficult to buy coal even at very high prices. This scarcity was particularly felt in Trondhjem and Christiania and peat was tried by many who had never before attempted its use. It proved so satisfactory that the demand continued even after the coal situation eased off to some extent, and at present (April 3) dealers find it difficult to obtain sufficient supplies. Peat is cheap, and when well dried burns with a hot

flame and little or no odor. The coal strike, therefore, indirectly proved of benefit, for a permanent market seems to have been created for a much larger amount of peat than was ever before used, and in a country that is entirely dependent upon others for its fuel supply this is of importance. Toward the latter part of the year, with large imports, coal prices were reduced somewhat, but even at the end of 1912 they were higher than normal. While no industries were seriously affected several manufacturers found it necessary to raise the price of their products owing to the high cost of their fuel supply. It is interesting to note that while the quantity of coal imported in 1912 was only a little more than 13 per cent greater than in 1911, the value was nearly 57 per cent greater.—Consular Report, May 24, 1913.

Mining Peat with a Hydraulic Dredge. A novel method of moving peat from the bog is in operation near Lakeville, Ind. The dredge is equipped with a rotary cutter extending across its bow, which cuts a swath 26 feet wide and to the full depth of the bog. The suction pipe of a centrifugal pump follows immediately behind the cutter. The pump takes the raw material from the bog and delivers it into drainage bins located on the bank, 24 feet above the level of the bog. There are three of these bins, each having a capacity of 3,900 cubic feet. Each bin is 42 feet long and is provided with a chain drag conveyor extending its full length. According to Mr. Van Glahn, of Toledo, Ohio, who is in charge of the work, it requires about 10 hours to fill a bin. It is then allowed to stand for 48 hours, when its contents are thoroughly drained. Five and one-half tons of the material, as delivered to the tanks, yield, after 48 hours' draining, 1 ton of peat containing 12 per cent moisture.—Steam, vol. 9, 1913, p. 70.

Peat Moss Litter Manure. Some time ago a report by Dr. Voelcker was published on peat-moss litter, in which that gentleman ascribed alleged ill effects of this manure to its acidity, and to the consequent unhealthy, imperfectly oxidized condition of the soil (iron compounds being present in the soil in the ferrous condition). The English Board of Agriculture give, in regard to the foregoing, in the current number of their official organ, a summary of an article from "Biedermann's Zentralblatt für Agrikulturchemie." This publication refers to the good results obtained with this manure in other countries, and claims that the acidity of peat moss litter manure is not too large to be neutralized by the bases of a normal soil without causing the reduction of ferric compounds into ferrous compounds. Laboratory experiments carried out at Jonkoping, Sweden,

with two samples of peat-moss litter of marked acidity, mixed with various manures and examined when fresh, and when four weeks, six weeks, and three months old, showed in each case that the acidity of the peat moss litter was neutralized by the ammonia of the manure. At the experimental grounds at Flahult and Torestorp peat moss litter manure on both ordinary and moor soils has given good results with garden crops, both as a top dressing and when mixed with the soil. The manure is also much used by Pallice, $12,632; Bremen, $10,601; Sevilla, $10,094; Zwyn-Swedish commercial gardeners for all crops. The advantages claimed are that it is the best material for absorbing excreta, and for minimizing the unavoidable loss of nitrogen in stable manure; that it has a deodorizing, and hence, disinfecting effect on the manure; and that the manure made from it is more efficacious than when other materials are used as litter.—Commercial Fertilizer, March, 1913.

Peat Molasses for Cattle Feeding. The use of molasses mixed with peat for cattle feeding was common some 10 years ago, but at present the demand has fallen off considerably. The ingredients now most usually mixed with molasses to be used for feeding purposes are wheat bran, brewers' drainings, palm kernel groats, ·or cocoanut groats. Nevertheless, there is still a regular sale for peat molasses. The present average wholesale price is 70.2 cents per 100 pounds. A prominent local dealer in feed stuffs believes that importation of peat molasses for feeding purposes is almost impossible because of the high sugar duty, which would be prohibitive for peat molasses on account of the low selling price. Furthermore, he asserts that feed stuffs containing molasses are very difficult to ship oversea, as the molasses easily gets moldy under the influence of damp air. For the same reasons an export of peat molasses from Germany to over-sea countries is out of the question.—Consular Report.

Peat Powder as Fuel for Locomotives. Recent announcement that Hj. von Porat, a Swedish engineer, had perfected a process for utilizing peat powder as fuel for locomotives has awakened interest in the possibility of developing the extensive peat bogs of Sweden.

The powder is manufactured by the Ekelund process. The Aktiebolagat Torf factory has been in operation several years at Back Moss, Sweden, under the management of Mr. Herman Ekelund, inventor of the powder process. It does not appear that the Ekelund process has made much headway as yet, but

it is now predicted that in connection with the discovery of Mr. Von Porat the use of peat powder will in time become extensive.

In the Von Porat system the peat powder is fed by an automatic process into the furnace of the locomotive, which is especially arranged to consume it. The Ekelund process is on the market in various countries, including the United States, but little has been made public concerning the Von Porat method. According to Mr. Von Porat, the results obtained with peat powder may be summed up as follows:

Substantially the same results can be had from 1½ tons of peat powder that 1 ton of coal will produce. Peat powder may be burned with an admixture of about 5 per cent of coal. As to firing with peat powder, the work is almost nothing in comparison with firing with coal, because the powder is forced into the furnace by automatic process. No change had to be made in the boiler and none in the firebox, except installing the special apparatus. There is no difficulty in bringing the powder from the tender to the firebox, as it passes through a conveyance pipe. Another advantage in using peat powder is that no cold air can get into the firebox and neither smoke nor sparks escape from the smokestack.

As a result of Engineer Von Porat's invention, it is reported that a number of the Swedish railways are preparing to use peat powder instead of coal. It is said that the Halmstad-Nässjo Railway has purchased extensive peat bogs, and the Kalmar-Nya-Jernvägsaktiebolag is also preparing to use some peat powder as fuel. The State Railways, it is reported, have ordered two Von Porat peat-firing apparatus for experimenting with peat as fuel.—Consular Report, June 20, 1913, p. 1469.

Reclaiming Peat Bogs. It is somewhat remarkable that so little has yet been done to reclaim the Irish bogs and utilize the peat when so much of the same kind of thing has been accomplished in Holland and Belgium and also elsewhere, particularly in Germany. In Ireland it is estimated that there are 4,600 square miles of peat bogs, practically the whole of it unworked, whereas in the Netherlands nearly this area has already been cleared of peat and put under cultivation during the last 300 years. One instance given by a writer in the Irish Builder and Engineer tells of an installation on a peat bog 25 miles from Osnabrück in Hanover at which 210 tons of air-dried peat are used up daily to work a gas plant which drives three gas engines, each of 1,150 B.H.P. Current is produced and transmitted at 30,000 volts for various purposes over an

area of 25 miles radius around the central station. This installation has enabled the old steam plant to be shut down. The chief expense connected with working would be in draining the bogs, but it is estimated that it can be done and anhydrous peat supplied to the consumer at 2s per ton, which would leave a margin of 2s for profitable electric generation.—Indian Engineering, vol. 53, 1913, p. 117.

SOME RECENT PATENTS ON MACHINERY AND PROCESSES FOR TREATING PEAT.

Utilization of Peat. T. Rigby and N. Testrup, Br. Pat. 26,349. Nov., 1911. According to this process drying is effected by artificial heat after a preliminary drying, but by combustion of the product in ammonia-recovery producers it becomes practically immaterial if a large amount of the product has to be burned, since the by-products—sulphate of ammonia and tar—constitute a valuable commercial product. Of the peat, which may be air-dried or pressed peat, or partly air-dried peat which still contains more water than is desirable for ammonia recovery for example, more than 50 to 60 per cent is reduced to powder as far as possible by any disintegrating or pulverizing device, after which it is fed into a continuous drying device, where it meets a current of products of combustion of gases from the producers. Any suitable device for drying the finely divided material in a current of gas may be used.

The Extraction of Moisture from Peat. P. Richemonde, Fr. Pat., 447,552, Aug., 1912. The process consists in heating the raw peat to 60° to 100° C. and allowing it to cool. The moisture can then be removed by pressure. The process differs from the Ekenberg process in the lower temperature used and the absence of pressure during heating.

Drying Peat for Gas Producers or Briquets. P. Richemonde, Fr. Pat. 447,262, Aug., 1912. The disintegrated peat is pressed into a thin cake between two endless filtering bands which pass between perforated metal supporting plates or over a metal pulley and are suitably tensioned. The moisture is thus reduced to 60 to 80 per cent. The peat is then further dried by exposure to hot air or to the heat of the sun. A suitable hot-air dryer comprises a chamber through which large quantities of hot air are blown in the upward direction, whilst the peat cake, in small pieces, travels from the top downwards in a zigzag path on a series of endless bands.

Fuel from Peat. N. Testrup and T. Rigby, Br. Pat. 27,150. Sept. 7, 1911. Claim is made for the use of press cakes or bri-

quets of wet carbonized peat in smelting operations, in the reduction of iron ore, for example, that peat becomes coked as it descends in the shaft, so that in the reaction zone it has become substantially or entirely coked. The shaft gases are treated for the recovery of nitrogen and tar, and the high percentage of carbon monoxide usually present in the gases makes it advantageous to introduce them into the foul main of an ammonia-recovery gas producer.

Distilling Peat. A. R. Tattersall and A. P. J. Archbold, Br. Pat. 5,343, March, 1912. This invention relates to an apparatus for the distillation of wood, peat, and other substances, and consists of one or several cylindrical iron retorts, each being provided with a metal jacket surrounding the body of the retort. One portion of the jacket forms a flue, whilst the distillation products pass through the other portion on their way to the condensers, which consist of metal vessels containing pipes through which cold water circulates, baffles being inserted in the condensers to compel the gases and volatile products to pass around and between the pipes. The liquor, which is separated from the gaseous and volatile products, is discharged through a trapped pipe into a receiver. The uncondensed gases pass into the air through a tower, or they may be used to heat the retorts. The method of working is to pass the gases from the retort which is carbonizing through its own jacket, thence through the jacket of the cold retort, which is charged ready for firing. By this means the hot gases warm and dry the material in the cold retort, and lose a corresponding portion of their own heat before passing through the condensing apparatus. The pyroligeneous acid is treated in suitable vats provided for this purpose.

Extracting the Natural Moisture from Bog Peat. S. L. Elborne and H. Godsal, Br. Pat. 3,367, 1912. This invention relates to alkaline treatment of peat in the presence of a large volume of water for rendering it capable of being dried by pressure. For such purposes, according to the invention, the peat and water are subjected at boiling temperature and at or about atmospheric pressure for a brief period to the action of a small quantity of an oxygen compound of an alkaline earth metal in solution. Preferably the selected compound is alkaline to litmus, as lime, the treatment being complete when the natural acidity of the peat has become neutralized and ordinarily, provided the mass be thoroughly agitated, taking place almost immediately after the boiling temperature has been reached. The use of hydroxides, carbonates, or the like, of the alkali metals should be avoided since their effect upon the peat interferes with satisfactory drying by pressing.

WHEN THE LAST OF LIFE'S PICTURES IS PAINTED.

By Rudyard Kipling.

When the last of Life's pictures is painted,
  And the tubes are twisted and dried,
And the oldest of colors has faded,
  And the youngest critic has died,
We shall rest, and, faith, we shall need it,
  Lay down for an eon or two,
Till the Master of all good workmen
  Shall set us to work anew.

And those who were good shall be happy,
  They shall sit in a golden chair,
And shall splash at twenty-league canvas,
  With brushes of camel's hair.
They shall have the real saints to paint from,
  Magdalene, Peter and Paul;
They shall work for an age at a sitting,
  And never be tired at all.

And only the Master shall praise us,
  And only the Master shall blame,
And no one shall work for money,
  And no one shall work for fame,
But all for the joy of the working;
  And each in his separate star,
Shall paint THE THING as he sees it,
  For the God of things as they are.

BOGS.

By Mudyard Pipling (with proper apologies).

When the last of the Peat Bogs is gathered,
  And in chunks is twisted and dried,
And the Oldest Fake systems exploded,
  And the youngest of Knockers has died.
We shall rest, and, faith, we shall need it,
  Shall repose for an eon or two,
Till the **Sphagnum** by blooming and rotting,
  Forms a myriad bogs that are new.

And those who were good shall be happy,
  On an Ocean of Moss Litter fair;
They shall work with a million-ton shovel,
  And dry by their own vast hot air.
They shall dig to the thousand-foot level,
  And never strike bottom at all,
For the Earth shall belong to the Peat Man,
  With never a snag nor a stall.

And, as for the products, they're legion,
  Paper Pulp, Briquets, and Mull,
Ammonia Nitrates and Tannin,
  Ground out by knives, never dull.
And all of the Public shall purchase,
  Even Bankers shall buy till they bust,
Till THE PROFITS piled up by the Peat Man
  Cause cracks in the Earth's solid crust.

[**Note**—The above is a Peat Effusion sent to Peater E. V. Moore to commemorate a very pleasant evening spent in Chicago, Ill., and was written by Mr. Frank J. Root.]

Journal of the American Peat Society

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THE SEVENTH ANNUAL MEETING OF THE AMERICAN PEAT SOCIETY AND JOINT MEETING WITH THE CANADIAN PEAT SOCIETY, MONTREAL, CANADA, AUGUST 18, 19 and 20, 1913.

The Executive Committee of this society accepted the hospitable invitation of the Sister Society in Canada, primarily because it was evident that there would be something for the most experienced peat man to learn by so doing. It was known at the time of the acceptance that both the peat-fuel plant at Alfred, Ontario, as well as that at Farnham, Quebec, would be in operation, and that both plants would be open for inspection to the visiting societies. This was the great attraction, two peat-fuel plants in full operation on a commercial scale, and it was the strongest one ever offered to the Amercian Peat Society in its short history.

The city of Montreal itself, one of the most interesting cities in North America, both from its beauty and from its long history, was deemed an added attraction and to those who attended the meeting this proved true. The visit to this famous city was well worth the effort of making the journey, even in the heat of August, and amply repaid those who attended the meetings for making it.

The reason for holding the meeting at the time chosen was obviously to be able to see the two plants in operation under conditions which would not involve their owners in any extra expense or trouble. If the meetings had been postponed until September, the digging season would have been past and machinery that had been housed for the winter would

have had to be taken out and put in operation to give a demonstration. As it was, the opportunity was given to see the entire process of producing peat fuel as it had been carried on at both the plants, simply as a part of the regular season's work as the drying grounds amply testified.

In Montreal, the meetings were held in the beautiful new building of the Canadian Society of Civil Engineers, whose officers most kindly and courteously tendered the use of the lecture rooms and reading rooms to the visiting peat societies for their meetings.

The attendance of members of both societies at the meetings was disappointingly small, especially to the officers, who had labored through the trying weather of the weeks preceding the meeting to provide a suitable program and to attend to the numerous details required to make any meeting a success. When it is remembered that this work was all done by busy men, at no cost to the Society except for printing and postage, the members who failed to show interest in the meeting certainly would do well to consider how long this work will be done for them in this free-handed way. There certainly should have been more peaters present from the United States.

There was no lack of interest and enthusiasm in the meetings, however, on the part of those who attended them, nor in the papers read and the discussions that followed their presentation.

As was shown by the announcements of the meeting, but a single day of the three set apart for the convention was devoted to the reading of papers and the regular business of the annual meeting, because the location of the two plants which were to be visited was such with respect to the city of Montreal that but one could be visited in a single day.

Therefore the papers were read and the formal business of the annual meeting transacted on the opening day, August 18th, and three full sessions were held in the fine new lecture room of the Canadian Society of Civil Engineers.

The Morning Session.—The meeting was called to order at 10 o'clock and in the absence of the Presidents of both Societies, Mr. Carl G. Kleinstueck, of Kalamazoo, Michigan, vice-president of the American Peat Society, presided. After the usual preliminaries, notices, etc., the following papers were read: "Practical Peat Utilization" (President's Address), by John N. Hoff, New York, N. Y.; "The Full Meaning of Moisture in Peat," by Robert Ranson, St. Augustine, Fla.; "A Contribution to the History of Peat," by Dr. Herbert Phillipp, Perth Amboy, N. J.;

"The Utilization of Peat in Agriculture as a Substitute for Manure," by J. N. Hoff, New York, N. Y.; "How We Drain Our Bog," by Dr. J. McWilliam, London, Ont.; "Peat in Agriculture," by W. R. Beattie, St. Louis, Mo.; "Peat-Moss Litter; Some of Its Uses; Its Manufacture, and Its Future on this Continent," by W. F. Todd, St. Stephens, N. B.

The discussion of the papers was limited to ten minutes each. The papers will be published in this and subsequent numbers of this Journal.

Afternoon Session.—The afternoon session commenced at 2 P. M. Mr. P. L. Smyth, of Montreal, the vice-president of the Canadian Peat Society, presided. In opening the meeting he said:

"I am very glad that we are holding this joint meeting, not only because of the pleasure it gives us to welcome among us our friends from the United States, but also because I am sure the intercourse between members of the two societies will tend towards the further development of the peat industry in all its branches. Personally I am interested in the production of peat for fuel. Others are interested in it from an agricultural point of view. I am interested in it also from that point of view, because at our little plant at Farnham our superintendent has carried on some interesting experiments as far as agricultural products are concerned, and has met with more or less success.

"There are two plants on a commercial basis in Canada—one managed by Mr. E. V. Moore, of Peterborough, and the other by Mr. Carlsson and myself. I think that any of you who are interested in seeing fuel made will be well repaid in visiting either the one or the other. Mr. Moore has certain ideas of his own which I consider highly commendable. Mr. Carlsson, our own man, has put his ideas into our plant, which is making peat fuel on a commercial basis. Both these plants it would well repay you to see. With these few words, and with the hope that our meeting will prove interesting and instructive to all, I bid you welcome."

Mr. Carl Kleinstueck, of Kalamazoo, Michigan, asked if anything was being done in Canada in the production of peat litter. He said this had been imported from European countries into New York in considerable quantities. "I was in Holland in 1902, and the U. S. agent there had strict orders from the Secretary of State to give me all the help he could in investigating the peat litter industry. He welcomed me with open arms and said, 'I am very glad that America is waking up—even if it is slowly—to the peat-litter business. I have never been there,

but I learn that right across from New York in New Jersey you have exactly the same peat as is being used for litter here in Holland, and if I appreciate the conditions you can produce from it peat litter for $2 or $3 per ton.' Hundreds of thousands of tons of this litter have been imported into New York and sold for as much as $15 a ton, and we wise Americans have been neglecting the very same thing which is right at our doors, and might be put on the market for $3 a ton. That is the way with us Americans, we must have things imported, and look stylish, while the good things at home go begging. It is very gratifying to me, however, to find that our imports of this peat litter have fallen from 185,000 tons a year to 9,000 tons. In another ten years I dare say we will have no use for imported peat litter."

Professor C. A. Davis of the U. S. Bureau of Mines, Washington, D. C., said he would like to know where Mr. Kleinstueck got his figures as to the importation of peat litter.

Mr. Kleinstueck: From the Rotterdam agent of the Holland-American Steamboat Company, who is the American consul there. When 185,000 tons were being imported, it was at the time when New York had horse cars. Besides that, some large stock farmers used peat litter at that time.

Mr. Julius Bordello, secretary-treasurer of the American Peat Society: There must be some mistake about large deposits of peat being across the river in New Jersey. There is no peat there fit for peat litter. We have been looking for several years to find such peat. There is some in Dutchess County, however.

Mr. Kleinstueck: Well, that is nearer than Holland.

Prof. Davis: Possibly it would cost less to take it across the ocean than it does across the river.

Mr. Kleinstueck: If Prof. Davis thinks there is no peat litter in the United States, I challenge him to come to Michigan, and I will walk him tired on bogs covered with peat litter of Sphagnum moss, ten to twelve feet deep.

Mr. Smyth: One meets with suitable bogs all over this country. Mr. Carlsson who has examined bogs for us might perhaps let us know how often bogs have struck him as suitable for litter.

Mr. Carlsson: Such bogs exist more in the west than they do in the east, especially in Manitoba and Saskatchewan. In fact, in the Eastern Provinces, I have not seen one. None of them with the peat of such a character as to be suitable for litter have depth of any account.

Mr. Bordollo: We are trying to start a peat litter industry

in Dutchess County, New York, but the difficulty is the question of cost. The freight from the chosen bog to New York is $2 per ton. Delivery across the ferry to New York is 80 cents to $1.50 per carload extra—and a car loads only three tons.

Peat litter in Holland costs $5 a ton, and the steamship company sometimes when it has not enough freight, will take it from Holland to New York for as low as from 50 cents to $1.50 a ton. Thus it is landed here for from $6.50 to $7.50 a ton. The thing here is how to get peat on the market cheaply enough. The railroad freight rates are enormous. If our peat deposits were 100 miles from New York, Holland would undersell us. All of these questions have to be taken into consideration in order to make American peat litter a commercial proposition. The railroads should give special quotations on peat. At present peat is not even listed, and they charge on the highest basis. When we complain of this, they say, "Ship some, and we will make a price." There are a great many other difficulties to be encountered and overcome before we can get a peat litter production started. The thing is being tried out now, but it will be a few months before we can tell how cheaply we can deliver the peat to the market. I think it can be done for $6 a ton, including freight.

Prof. Davis: There are very few bogs in the Eastern United States which I consider very promising for peat litter, because in most cases you have to go over too much ground to get a sufficient quantity of the raw material to make it worth while. As to the bogs which Mr. Kleinstueck mentioned in Michigan, I spent three years looking over the bogs of that state. As a general rule there is little or no Sphagnum in them, and where there is Sphagnum peat it is only about 3 to 4 feet thick. Below that we come to turf, and below that, material which is better fuel than litter. While there are many bogs which have superficial deposits of Sphagnum peat, there are few of any depth. There is another consideration which must be taken into account when discussing this question of peat litter. One of the most prominent European journals gives nine different kinds of peat which make good litter. In fact any peat not too much decomposed will make good stable litter. It is absorbent, a good disinfectant, and spongy enough to make good material for stock bedding.

Mr. Kleinstueck: I myself have experimented with using it for livestock, and I find that any kind of peat makes excellent beds. The absorbent nature of peat makes it excellent for the prevention of sore feet. In fact persons who use it consider that if they had to get peat litter at twice the price they pay

for straw, it would still be preferable. It makes the stables sweet, and makes far better manure for land than straw, which is not so absorbent as the peat. It mixes readily with soil, and retains the ammonia far more completely than straw.

Prof. Davis said he had been talking with a man who kept a livery stable and who had been experimenting with peat litter. He had imported it from Holland and it cost him on the car $16 a ton, but he said he would use it in place of straw at $8 a ton, if the peat litter cost $20 a ton.

Mr. G. Herbert Condict, of Plainfield, N. J., said that in Florida they thought it a crime to use peat for fuel, because it had so much more value as a fertilizer. The bogs there were under water for a great part of the time; in fact a great deal of the peat at one place was taken from the bottom of a lake 18 miles wide, 4 1-2 miles long and 5 to 15 feet deep.

After this informal discussion the following papers were read and some of them were discussed at length (an attempt will be made to publish in this Journal the discussion following the papers as they are printed in this and later numbers). "The Utilization of Peat Tide Land," by G. Herbert Condict, Plainfield, N. J.; "Peat Power Plants in Europe," by B. F. Haanel, Ottawa, Canada; "The Economic Utilization of Our Peat Resources," by Arthur J. Forward, B. A., Ottawa, Canada.

Evening Meeting.—This meeting was presided over by Prof. Charles A. Davis, and the following papers were read: "Dried Peat as Stock Food," by John Wiedmer, St. Louis, Mo. (Read by the secretary of the American Peat Society); Annual Report of the Secretary and Treasurer of the American Peat Society; election of officers for ensuing year; reports of committees; "The Production of Peat in 1912," by Charles A. Davis, Washington, D. C.; "Some Results of Experimental Work with Muck Soils in the Greenhouses of the U. S. Department of Agriculture, at Arlington, Va. (illustrated with lantern slides), Prof. H. C. Thompson, Washington, D. C. Adjournment.

Excursion to Alfred, August 19th.—On the morning of the 19th, those members of both societies who wished to visit the peat-fuel plant at Alfred took an early west-bound train on the Canadian Pacific R. R. This made it possible to reach the plant in time to see and study the details of field operations, the new and very practical machinery, and the bog, in a leisurely and thorough manner. The party was accompanied and guided by Mr. Ernest V. Moore, M. E., the engineer and manager of the plant, under whose direction, and largely by whose personal efforts and skill, the machinery had been built, installed and

put in operation. The owner of the plant, Mr. J. M. Shuttleworth, of Brantford, Ont., was unluckily absent in Europe on business and could not see the pleasure given his guests on this excursion.

Landed at the railroad siding at which the products of the plant are shipped, the party was given what was to most of them a rare or novel spectacle. The season was exceptionally dry, and, in some way, possibly by a spark from a passing locomotive, the vegetation on a part of the bog adjacent to the area then being excavated, had been set on fire. Fanned by a gentle breeze, the fire ran rapidly across the open bog, leaving only a blackened surface behind it. The speed at which the line of fire advanced was surprising, considering the slight force of the wind. Doubtless, this lack of wind prevented the flames from crossing the wide drainage ditch which separated the part of the bog where the fire was, from that on which operations were being carried on. As it was, the working force had to suspend regular operations for a time, and beat out the fire where it had found a way around the ditch and threatened a building.

A most interesting phenomenon accompanied the ascent of the smoke clouds over the bog. Several smoke pillars or "spouts," identical in form and appearance with water spouts, formed, and extended upward to a great height. These "spouts" were slender columns of whirling smoke and moved slowly across the burned area, picking up ashes and other debris as they proceeded, only to drop them when the rotary motion of the air current, which had formed the spout, ceased. The party felt under great obligations to Mr. Moore for giving its members so unique an exhibition.

It is known to most of the members of the American Peat Society that the site of the present operations at Alfred is the same as that of the demonstration plant installed in 1909 under the direction of Dr. Eugene Haanel, by the Mines Branch of the Canadian Department of Mines. The present proprietors have the advantage of the clearing and drainage work done for the Government plant, but other than this, the equipment is entirely new.

The present plant has already been so fully described by Mr. Moore in a recent number of this Journal* that the briefest summary of its essential parts will suffice here.

The operations of digging the peat and of macerating, conveying and spreading it to dry are all carried on by strong,

* A Successful Peat Fuel Plant, E. V. Moore. Jour. Am. Peat Soc., Vol. V, No. 4, p. 205 (Dec., 1912).

well-designed machines, which are operated by electricity generated by a small electric plant built on firm ground at one side of the bog. The small frame building which houses the boiler and generating machinery is the only permanent building of the plant except a small office building, and two low sheds for storing the dried peat fuel.

The peat is dug by a powerful chain and bucket digger which makes a sloping cut and delivers the peat to the hopper of a large macerator. This is of sufficient capacity to reduce the raw peat to a fine pulp as fast as it is received from the digger. From the macerator the wet peat pulp is forwarded by a screw conveyor, at the end of which it is dropped into large suspended buckets or cars. These, as fast as loaded, are moved away by an aerial cableway; this runs 900 feet straight away out over the surface of the bog, at right angles to the digging trench. This cableway is easily movable throughout its entire length, including the supporting and anchoring towers. The towers are moved forward on short lengths of track whenever the digging machinery is moved, a few moments sufficing to change the position of the entire equipment and get it into line again.

After the wet peat pulp is loaded into the buckets, it is rapidly carried along the line of the cableway to that part of the drying field on which it is to be spread. Here the bucket is stopped for an instant and its contents are turned out directly into the hopper of the spreader or field press, and the empty bucket, with scarcely a perceptible halt, is sent forward again to the loading place.

The spreader is electrically propelled, the current being received through overhead trolley wires, instead of being dragged along by a cable as in the older forms of this device. It delivers the peat pulp at the rear end positively, through a series of tubes with a rectangular section, which are placed side by side, horizontally. The peat, therefore, is laid out on the rolled surface of the bog in a series of continuous, prismatic strands of uniform width and thickness. These are later cut into brick-shaped pieces by the use of a series of sheet-iron disks equally spaced and mounted on an axle.

This was the whole process, except that, as the peat bricks became dry enough, they were turned, and, later, stacked. The interesting experiment was being tried of letting some of the bricks dry completely without turning and stacking them. The bricks thus left were cracking considerably but otherwise were progressing favorably towards salable dryness.

The output of air-dry peat with this equipment, which was

operated by 12 men on the field, and men additional at the power house, was reported to range from 35 to 40 tons to about 60 tons a day. As this was the first operating season and much of the machinery was novel in construction and as the laborers employed were entirely unskilled in its use, it seemed probable that the average daily output would be increased during the next operating season, and the cost of production per ton lowered.

This plant, by all who went to see it, was considered to show most conclusively the advantages of having strong, well-built machines, of large capacity, and easily movable, for digging and maceratinig the peat and of having these so located with respect to each other and to the drying grounds that at all times there should be no break in the series of operations necessary to get the peat, macerate it and get it spread for drying.

The easily movable aerial cableway was voted the most notable innovation and the spreader the next in importance, although the powerful digger and the ease with which it was moved and operated came in for its full share of praise.

Space will not permit the discussion of the luncheon here. However, it was discussed with great and satisfying earnestness at the proper time and place and all present were actively interested in it. Late in the afternoon the party returned to Montreal with a feeling that the occasion had been a red-letter day in their lives and in the history of peat-fuel production in North America. A hearty vote of thanks and of congratulation was tendered to Mr. Moore and through him to Mr. Shuttleworth, before the party broke up.

In the evening the Canadian Peat Society gave a banquet to those of the American Peat Society who remained in Montreal, and this proved a most enjoyable occasion. It was entirely informal and those present got more closely in touch and better acquainted with each other than had been possible before. Such meetings increase the good feeling already existing between the members of the two Societies and unite them more closely in the determination to win in the work they have set out to do.

Excursion to Farnham, August 20th.—The second day's excursion was no less interesting than the first, although several who had attended the first failed to appear to start on the second. They had seen enough.

The start was again made early in the day, under the guidance of Mr. P. L. Smyth, of Peat Industries, Ltd., but in an easterly direction and on another line of railroad. The arrival

at the plant, was, in this case, not made a cause for illumination, and there were no fireworks, but the party was cordially greeted by Superintendent Carlsson and his charming wife, who made the members of the excursion feel that they were very welcome.

The visit to the field operations showed that Peat Industries, Ltd., was more than a name and that the company was not limited in industry. The work of making peat fuel was going forward at a rapid pace, while stacks of peat already dry, and areas of the bog covered with the freshly laid-out peat and that partly dry, gave testimony that we were not simply watching a "demonstration," but an everyday business operation of an established, well-equipped plant.*

The peat was dug by a chain and bucket digger, mounted, with the engine, the macerating machine and conveyors on a platform car, which was self-propelling and provided with "caterpillar traction," so that no rails or track were needed. The motive power was furnished by a gasolene engine, which was reported to work well for this purpose.

After the peat was dug and macerated, it was delivered by a conveyor to tram cars on the side of the platform opposite to the excavating trench. The pulp fell into the tram cars, which, when full, were made up into short trains and drawn out to the part of the bog devoted to drying by a small locomotive using kerosene for fuel in its gas engine. This locomotive not only drew the loaded cars to the drying grounds, but returned the empty ones, and, during the shipping season, was used in drawing the dry peat from the stacks to the loading platform.

The peat pulp after reaching the drying field, which, as at Alfred, was near by the digging trench and extended out at right angles to it, was dumped into the hopper of a field press or spreader, drawn by a slow-moving cable, and spread out in a sheet the width of the press and about 5 inches thick. This sheet was cut into ribbons, lengthwise, by markers which were attached to the rear of the field press; it was marked off into bricks by cross-cutting the marked sheet with properly spaced metal disks. The length and width of the bricks thus made were perfectly controllable, but the thickness was somewhat irregular because of the uneven surface of the bog and its covering of shrubs.

Here was seen the process of stacking the dry peat. The dry peat blocks were picked up by boys and thrown into baskets, which, when full, were taken by the two boys who had filled them to the stacks. The piling was done by men, who,

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* An Up-to-Date Peat Plant, L. B. Lincoln, Jour. Am. Peat Soc., Vol. V, No. 1, p. 18 (Apr., 1912).

like the boys, are paid by the thousand pieces handled. This work was reported to add little to the cost per ton of producing the peat.

The peat blocks were piled rather loosely in the stacks, so that the air could circulate between the blocks and complete the drying. The stacks were of various lengths, but about 8 or 9 feet high, with a pitched roof, slightly protected against rain by a thin thatch. The peat was carefully laid up on the outside, but more loosely placed on the inside to allow for some movement of the air through the stacks.

After the field inspection was completed a most delicious and satisfying luncheon was served at the home of Superintendent Carlsson, and not a member of the party will regret that he went on the excursion, as long as he remembers that luncheon!

Incidental to the examination of the plant and of the various processes and machines in use, there were developed many interesting discussions and criticisms both on the field and afterwards, but to get the benefit of these, one has to be present and take part in them. Those who stay away miss these important phases of such meetings absolutely, and by so much are the losers.

The general sentiment of the party was expressed in enthusiastic terms at what they had seen of the workings of the machinery and at the excellent results obtained by it, both in quality and quantity of output.

Like all good times, this one came to an end, when the train which was to take the party back to Montreal, whistled. Thanks were voted Peat Industries, Ltd., for the many favors shown, and to the genial superintendent and his wife for their hospitable entertainment, and then the party boarded the train, waved farewell and the meeting of 1913, the most notable one yet held for real accomplishment, was at an end.

Note.

The official minutes of this meeting including the business transacted, were not available for publication in this number, but a list of the officers elected for the present year and the report of the Secretary will probably be published in a later issue.

PRACTICAL PEAT UTILIZATION.

PRESIDENT'S ADDRESS.

By J. N. Hoff.

(Read at the Montreal Meeting.)

The prime object of the American Peat Society is to further the practical utilization of peat, humus, or muck in the arts and agriculture—by co-operative work, by interchange of ideas among its own members and others, and by publication in its Journal and discussion at its meetings of the various processes of utilization in vogue; to unearth fraud, and point out, if possible, causes of failure in unsuccessful peat enterprises, and possible ways of success.

Much real work has been done, yet we can hardly say that we are even on the threshold of real success. Ignorance, prejudice, obsolete methods, and worse, have first to be cleared away, and, from the débris, ways and means must be devised to do successfully what in most cases heretofore has been failure of the most complete order.

The one great incentive to success is profit. What then is the most profitable way to use peat? Its uses are various, the principal ones being, as we all well know, for fuel, litter, bedding, insulating and packing material, paper board, fertilizer filler, or as a direct soil improver and, in the form of peat or muck, in place of a soil for the direct raising of crops.

In the millions of acres in North America there is a vast difference in quality and character of peat deposits; therefore, the initial step is to examine and classify our deposits, which, coupled with location of markets for competing material, should determine what the particular deposit, if readily marketable, is best adapted for.

Peat for fuel should be low in ash, thoroughly decomposed, dense, and high in fixed carbon and the deposit must lie outside the territory of cheap coal or wood, as well as be accessible to and near a market.

Peat for litter or allied purposes must be only semidecayed, light, porous, and very absorbent.

Peat for fertilizer filler must be high in actual humus and nitrogen content, well supplied with lime, and be naturally fertile as indicated by the natural growths thereon. Peat or humus soils, with characteristics similar to those mentioned, are

adaptable to agriculture, if drainage and irrigation is possible and consuming markets are reasonably near at hand.

Choose, then your peat industry according to the character and location of your deposit if you would attain commercial success.

Undrained tide-level bogs are the most difficult to utilize as compared with those where real drainage is possible. Peat in such bogs must be taken out by bucket or hydraulic dredges, after which the various processes are similar to those used on drained bogs.

We refer you to G. H. Condict, Robert Ranson, and R. V. Fulton, of this Society, for practical suggestions as to handling undrained or tide-level bogs.

Bogs suitable for litter and the practical side of the peat-litter business in all its phases have been a life study with our most helpful Secretary, Mr. Julius Bordollo, who is always ready to shed light on this very important and, in America, greatly neglected peat industry.

Peat litter is five times as absorbent as straw, much cheaper to produce, and much more valuable as manure when spent. We in the States import several thousands of tons from Germany and Holland each year, regardless of the fact that we have within our borders peat beds containing the best litter obtainable. It is cheaper than cork and a better insulator. Why don't we utilize it?

You Canadians and our German friends have brought the fuel industry to success and your processes should render the peat-fuel industry of vast importance in the near future.

Then there is the valuable part the Mond gas producer plays in the peat-fuel problems. The Italian plants show in a most practical way that the whole process of preparing peat fuel and profitably utilizing it can be accomplished on the bog itself and the products carried to market by wire in the form of electricity.

Perhaps the most widely applicable and most general use to which peat of proper character can be put, however, is as a fertilizer or directly to produce crops—agricultural peat—which brings us to cleared and drained fields.

Large tracts of marsh or swamp land should be utilized if possible in order to afford proper machinery and carry out the project in such a way as to be economical and reduce the unit-production cost.

The best ditching device known to the writer for economical work is the ditcher made by the Buckeye Traction Co., and anyone considering the drainage of bog lands should examine

its advantages and cheapness of operation. Ditches 4 to 5 feet deep and 2 to 3 feet wide at the top can be dug with it for less than 10 cents per linear foot.

Large ditches 6 to 8 feet deep and 6 feet wide can be dug almost as cheaply, except for the added first cost of the larger machine.

Compared with any other method, clearing away trees and stumps is best done either with dynamite or with a caterpillar tractor, which will pay for itself in a short time. The same tractor will answer to pull your bogging machine, gang plows and power harrows, enabling you to plow and harrow 20 acres a day, which is more than 10 teams of horses and 10 plowmen could accomplish in the same space of time, even on a well-drained bog.

There are several good tractors of proper type now available, which should make agricultural work on peat lands practically horseless.

Drainage and clearing thus carried on by proper machinery will cost from $25 to $50 per acre.

Open ditches are better than tile drains for reasons that are obvious. In the case of a heavy downpour of rain on a large, flat surface, tile will not easily accomodate itself to volume; it is apt to clog, and the soft yielding character of peat soil causes the tile to dip or raise and thus destroy the drainage levels.

On the other hand, open ditches can be made large, are easily kept clean, will effectively drain in a short space of time, and are much less expensive. They should be kept as free as possible from weeds, to insure good drainage, and prevent the spread of weeds to the cultivated fields.

For the production of filler or fertilizer on a drained and cleared bog, there is no better machine to dig, disintegrate, and spread the peat than one designed on the principle seen in James Dobson's peat digger. The proper use of his system should make the filler production a successful industry.

The fertilizer-filler industry has not been more successful mainly because the field work has not been attempted in a proper and comprehensive way.

Dewatering peat by various power presses has been a matter of much experiment but, as yet no marked success has been achieved. To attain success, such large masses of raw material must be handled at very low cost as to make the problem a serious one to work out in practice.

The success in filler production hinges on the method and cost of dewatering, as we have to reduce material containing

85 per cent of water, or even more, to that containing 10 per cent. That means handling at least 6 tons of raw material to obtain 1 ton of finished product; and 5 tons of water must be disposed of.

The most logical way is by sun-drying on the bog or very near it.

On a well-drained bog a team can harrow 10 acres and readily disintegrate, pulverize, and reduce the moisture content of the top inch from 85 per cent to 60 per cent in 24 hours. An acre inch means 80 tons, or 10 acres 800 tons, of raw material containing 680 tons of water. When reduced to 60 per cent of moisture, 500 tons of water has been disposed of by natural means, at a cost of a team and man with harrow one day, or, with a Dobson digger one day, 500 tons of peat containing 85 per cent of moisture can be reduced to 180 tons, thus disposing of 320 tons of water.

What other method will approximate these in cheapness? Surely no press can do it. These figures are from experience in large areas and under average conditions of rainfall in the operating season, that is, from spring to fall.

When peat is reduced to 60 per cent of moisture or less, it is friable, pulverulent, and easily subjected to further processes, rendering the completion of the drying process simple in almost any approved type of dryer that will dissipate 8 pounds of water for each pound of coal consumed.

With coal at $3 per ton, the fuel cost of drying peat, from a 60 to a 10 per cent moisture content will approximate 60 cents per ton of finished product.

Similar methods can be used in treating undrainable bogs, by first pumping the raw peat to suitable drying grounds.

One of the more recent uses of agricultural peat has been its preparation by disintegration and drying for direct application to upland soil to supply the needed organic matter or humus, in place of plowed-under green crops or manure.

We are approaching a horseless age. Supplies of manure are increasingly difficult to procure; it is unsanitary for transportation and use, and requires many times more in volume to give the same results produced by prepared peat or humus. Here is a vast and almost untouched field for peat utilization.

Professor Thompson will tell us how valuable this product is in greenhouse work, in place of the old manure-sod soil so expensive to make and so uncertain in character and composition. He can also tell us how valuable is agricultural peat in place for the production of truck crops, perhaps, after all, the

most profitable and lasting branch of peat utilization for steady profit and the greater good to mankind, in the role of vegetable food production.

PEAT POWDER AS FUEL FOR LOCOMOTIVES.

Recent announcement that Hj. von Porat, a Swedish engineer, had perfected a process for utilizing peat powder as fuel for locomotives has awakened interest in the possibility of developing the extensive peat bogs of Sweden.

The powder is manufactured by the Ekelund process. The Aktiebolagat Torf factory has been in operation several years at Back Moss, Sweden, under the management of Mr. Herman Ekelund, inventor of the powder process. It does not appear that the Ekelund process has made much headway as yet, but it is now predicted that in connection with the discovery of Mr. von Porat, the use of peat powder will in time become extensive.

In the Von Porat system the peat powder is fed by an automatic process into the furnace of the locomotive, which is specially arranged to consume it. The Ekelund process is on the market in various countries, including the United States, but little has been made public concerning the Von Porat method. According to Mr. von Porat the results obtained with peat powder may be summed up as follows:

Substantially the same results can be had from 1 1-2 tons of peat powder that 1 ton of coal will produce. Peat powder may be burned with an admixture of about 5 per cent of coal. As to firing with peat powder, the work is almost nothing in comparison with firing with coal, because the powder is forced into the furnace by automatic process. No change had to be made in the boiler and none in the fire box, except installing the special apparatus. There is no difficulty in bringing the powder from the tender to the fire box, as it passes through a conveyor pipe. Another advantage in using peat powder is that no cold air can get into the fire box and neither smoke nor sparks escape from the smokestack.

As a result of Engineer von Porat's invention, it is reported that a number of the Swedish railways are preparing to use peat powder instead of coal. It is said that the Halmstad-Nassjo Railway has purchased extensive peat bogs, and the Kalmar-Nya-Jernvagsaktiebolag is also preparing to use some peat powder as fuel. The State Railways, it is reported, have ordered two Von Porat peat-firing apparatus for experimenting with peat as a fuel.

PEAT-MOSS LITTER; SOME OF ITS USES; ITS MANUFACTURE AND ITS FUTURE ON THIS CONTINENT.

By W. F. Todd, St. Stephens, N. B., Canada.

This paper is written by an ardent enthusiast in the cause of peat utilization who has had long practical experience in the study of and work upon this material. I congratulate you upon the good work done by your society in the cause of peat and upon the high standing it has attained.

I use the term peat moss, because I think it describes the material I would bring to your notice better than any other.

I will not particularize upon the botany of our peat-moss bogs. This has been brought fully to your notice again and again. It is sufficient to say, that the best peat moss bogs are made up almost wholly of **Sphagnum** moss of the species **fuscum.**

This type of moss peat has the greatest absorptive power and longest life when used as litter. In Europe and perhaps on this continent, most of the **Sphagnum** bogs, whether dead or living, will make peat-moss litter and mull from their upper layers, and peat fuel from the lower layers. The quality of the peat moss will be determined by the age of the bog; its degree of humification, and the species of **Sphagnum** that makes up the greater part of its substance.

I am informed that in Europe, it is very rare, to find a bog that is composed solely of peat moss, that is, material suitable for moss litter, from top to bottom. This same statement may be true of bogs in many parts of Canada and the United States. but the bog upon which I did most of my experimental work is a raised **Sphagnum** bog, and is wholly a moss-litter bog.

Other bogs of which I know in this and the adjoining county are of the same character, and are among the finest to be found anywhere. The best peat-moss bogs are near the seaboard, where the fog and dampness give them their fullest and most luxuriant growth. Very little, if any, bush growth is found on them, and because of the **Eriophorum** or cotton grass that grows amid the **Sphagnum,** seen from a short distance the bogs have the appearance of old, run-out grass fields.

The description of bogs generally, as to their composition, their kind, and their plant growth, has been written so well and thoroughly by others and so often read by all who are interested in peat matters; that it would be only a waste of time for me to refer more than I have done to these points. But

in the future of the moss-litter business, when competition shall have become keen, purchasers will be governed by the cleanliness and absorptive powers of the samples brought before them, and they will select the sample showing the highest merit in other respects if the moisture content of a group of samples is alike. Therefore it behooves one who intends to manufacture litter alone, to select a bog of the highest quality.

Among the many uses of peat-moss, I shall select two, as being the most important uses to which the material can be put—for sanitation and litter.

The Use of Peat-Moss for Sanitary Purposes.

The peat must be in a rather finely powdered state to give the best results. In this state it takes up liquids and gases more quickly than if larger lumps or particles are used. It is a maxim in sanitation that a dry system of sewage removal is the best. Earth has been found unsatisfactory. Peat powder is a perfect medium in which to attain this proper sanitation. The wet or water-borne system of sewage removal, with its deadly danger from sewer gas, and its pollution of the water courses through which it flows will have to be endured in cities and towns, until saner regulations bring the science of sanitation to a more perfect state. Peat-moss or peat powder will kill infectious germs and destroy bad odors, completely. To persons living in towns, villages or the country districts, the use of peat-moss powder, in dry closets will prove a great boon in the way of comfort and health, to say nothing of the great saving it will make to agriculture. Peat-moss powder has a complete deordorizing power, with disinfecting properties. It has great power for absorbing liquids and gases. It resists putrefaction and fermentation until mixed with the soil bacteria and fungi. In the case of epidemics capable of being spread by the germs present in the excreta, this powder will hold fast if not entirely destroy these germs. If there should be a doubt upon this point, a 3 per cent solution of sulphuric acid mixed with the powder will certainly kill all infectious germs. To whatever it is applied, peat-moss powder stops putrefaction, destroys odors, and keeps away flies, which our best authorities now agree cause the spread of many infectious diseases.

The Use of Peat-Moss for Litter.

I have probably dwelt long enough on the sanitary uses of peat-moss. Let me now take up the use of peat-moss as litter or bedding under animals. In 1887-88 I placed upon my stock farm a large number of valuable trotting horses for breeding purposes. Upon some of the stock farms I visited

at that time, I noticed that imported peat-moss bedding was used. I was attracted by it, and at once began its use in my stables. I was more than pleased with its good qualities, and in my experience with it, I never found one fault to be charged against it. Indeed, so enthusiastic did I get from its use, that I set out at once to find deposits of a like material in my own neighborhood. This was the start of my enthusiasm for peat moss and its manufacture, an enthusiasm and hope that has never waned, in spite of all the bitter reverses and setbacks I have had.

In my use of peat-moss as bedding I have proven the following facts: that 1 ton of good peat-moss will last as long as 2 1-2 tons of straw; that in a box stall, one bedding properly handled can easily be made to last three months. In one box stall, on my farm, I used one bedding of peat-moss thirteen months and six days before removing it. I was making a test of it. In all that time no disagreeable odor arose from it. In the handling of at least 150 horses and colts on peat-moss bedding I knew but one horse that would eat it. This was one of my farm work horses, with a morbid appetite that craved mud, muck or anything of that nature. The eating of this bedding for weeks never had the least deleterious effect upon him.

This material when used for bedding is highly conducive to a healthy growth of the hoof and I cured the worst case of thrush I ever saw by the use of this bedding. A horse can be kept cleaner and healthier on this bedding, with a quarter less labor, than when straw is used. No drainage of the stall is needed. No ammoniacal or other odors arise from it, but the stable always smells sweet. No dust arises from this bedding if it is used correctly. There are two great claims that I can truthfully make for the use of peat-moss bedding that I have never seen mentioned by others. One is the fact that flies will not harbor in it, or breed about it, and wherever it is used wholly in a stable very few if any house flies will be found. This is a great boon, as the house fly is now looked upon as a great menace to health because of its known power to carry disease germs. This freedom from flies is brought about, partly because the peat-moss in itself is repugent to them, because of its powdery condition, and partly from the fact that there is no food whatever in it for them. I should point out however that this freedom from flies in summer can be attained only by removing the droppings of the animals 3 or 4 times a day and burying them under a slight covering of the used peat-moss. Otherwise flies will lay

their eggs in the droppings, and in a few hours the eggs will hatch out, unless stopped by the peat-moss.

The other great claim I make for the use of peat-moss bedding is its perfect freedom from danger of fire. You may explode a lamp or lantern upon it and you cannot set it on fire. The kerosene will burn out, and leave nothing but a slightly charred place where the oil burned. I have tested this again and again. I have lighted armfuls of newspapers on the bedding, but could never get it to burn. To smother flame, I would rather have one pailful of well-fined peat-moss bedding than two pailfuls of water. When you consider these safeguards from its use, and how clean and healthy an animal can be kept on a bedding of this material, you can judge that the use of it will grow greatly in this country.

By repeated thermometer tests in winter I have found peat-moss bedding two to three degrees warmer than a straw bedding. The best agriculturists of the past, and those of the present time, state that the condition most needed to insure certain and good crops is sufficient moisture in the soil throughout the growing season. With a great lack of humus in our soils, how can we hold and conserve moisture after our rains? I hold that the use of peat-moss manure when plowed into the ground will best and most quickly give this result. From the poorest to the very best peat-moss the range of absorption is from 8 to 28 times its own weight. The peat-moss particles become loaded with the water that percolates through the top sod during rain storms. This moisture is given up to the crop roots very slowly and gradually, when the upper layers of the soil dry out by surface evaporation. Thus by its use, a drought will be robbed of its power, heavy soil be lightened and made more permeable to air and water, and sandy and light soil will be made retentive of moisture. Peat-moss bedding, according to my experience, after use under animals makes a splendid fertilizer to apply to all crops. To start with it contains twice to three times the combined nitrogen found in the best barnyard manure. It locks up perfectly all the liquids from the animals (which is two-thirds of the total manurial value of the excretions) and gives it up only when the used bedding is mixed with the soil and fermentation takes place.

Moss litter will be found the best and cheapest bedding for animals. Horses and cattle, when bedded upon it, can be cleaned with very much less labor, and the stalls cared for in one-fifth the time it takes when straw is used. As stated above, it keeps the hoofs in splendid condition and is highly conducive to their quick and healthy growth. It is very cleansing

to the skin, and a white or gray horse will never show stains when bedded upon it. It will not take fire. It is a perfect deodorizer and disinfectant, killing cholera and other deadly disease germs immediately. Thus it proves one of the best safeguards against disease to those working about it. After use it is unexcelled as a fertilizer, and is entirely free from disagreeable odors that usually arise from highly concentrated manures.

Directions for Using Moss Litter.

By observing implicitly the following directions for using peat-moss litter as bedding, the highest satisfaction and economy will be obtained and the greatest pleasure will follow from its use:

If a box stall is used make the bed at least 6 inches deep.

Take the droppings out 3 or 4 times a day by laying a basket on edge and scraping them into the basket with a shingle or other piece of light wood. This is easily and quickly done and adds very largely to the durability or wear of the bedding. After the first 2 or 3 weeks' use, when the bedding gets a little moist on top, every morning take a three or four tined fork after the droppings are removed and before the horse is returned to the stall, and plow the moss (by shoving the fork forward and back through it) bringing the bottom moss to the top; then, with a short handled rake, smooth the bed down and it is done for the day. If there should be a very wet spot at any place in the bedding, take the wet litter out and, in case of a box stall, throw it to the edge of the stall. But in a narrow, standing stall the bedding had better be removed entirely from the wet place, and a shovelful of new moss put in its place. Follow this course every morning and the bedding will last week after week and form a fine, soft bed.

Close all sewers leading from stalls in which moss litter is used, as it absorbs every particle of liquid, and any loss of liquid injures its fertilizing value. When used in narrow stalls use a piece of plank or deal behind to keep the moss litter in if so desired. Should the bedding be a little dusty when first spread, give it a light sprinkling with a watering can for a few mornings and it will then wear for weeks without any further treatment in this particular. After use it can be stored, without risk, in any basement cellar, as it never heats and will not rot the timbers or woodwork.

It will last as a bedding in a box stall from 3 to 6 months, according to the season of the year. In a standing stall, where the animal is tied, the bedding need not be as thick as in the box stall, although it should be not less than 4 inches deep.

behind the animal. It should always be thick enough so that the liquid voided cannot go clear through to the floor, and be wasted for agricultural use by passing into the wood of the floor. A standing stall requires a piece of scantling say 2 inches or 3 inches by 4 inches at the back end of the stall on the floor to keep the bedding from spreading out on the stable floor. This can be made with beveled edges so as not to trip the animal when passing in and out. It will also be more comfortable if any part of the rump of the animal should reach it at any time when lying down at night. This can be easily arranged by any user of litter. If a strainer pipe is in the stall to take away the liquids, put something in and over it to keep any of the bedding from passing down into the pipe. The bedding should, and, if thick enough, will absorb every particle of the liquid, and drainage is needless. If building or repairing stalls, by all means put a cement floor and cement the sides up to at least 8 inches. This will make a permanent, lasting work.

I have said nothing but good of peat-moss litter. You may ask, is there not one fault to be found with it as we get it and know it? There is only one fault or objection that I have been able to find against it in use, and this a serious one. It is not an objection to the material itself, and is caused solely by the way it is prepared for market. This fault may never be remedied, but until it can, it will not be my duty to bring it to user's attention. I feel sure from my own experience that the use of peat-moss litter on this continent will increase by leaps and bounds when its good qualities are made known to people, and manufactories start up ready to meet the future demand. This continent with 110 or more millions of people uses only about 8,000 tons of peat-moss, while Great Britain alone used 180,000 tons in 1911.

This should not be, and I prophesy that the next few years will see a great change in this respect and the products of our peat-moss bogs will be called for from one end of the land to the other. As to the manufacture of peat-moss and peat fuel I have a great deal that I could say, but the limits of this paper in fairness to you are much too small to take up these subjects in it. In brief, however, I can say this, that I do not believe any process now being tried or worked on this continent or in Europe, as far as I can learn, is going to solve the peat fuel and peat-litter problem for this country, when we consider its selling value, and the exactions that capital will put upon an industry of this kind.

PEAT; ITS PAST FAILURES AND FUTURE POSSIBILITIES.

(The Times, London, Engineering Supplement, Mar. 7, 1913.)

There are few more melancholy records of misdirected human energy than the roll of patents relating to the various attempts to turn peat to commercial advantage. So many inventors have come forward full of hope and confidence concerning the profits to be realized, and have entrusted the details of their schemes to the Patent Office in the expectation of future reward and unbounded success, that the reader is tempted to believe that there really must be some elusive treasures lying concealed in the dreary wastes of peat bogs. In discussing the uses of peat, it may perhaps be useful to glance briefly at certain of the processes which have been propounded in the past, as indications of the lines along which effort has been hitherto directed.

Vignoles' Peat-Coke Process. The year 1850 was notable in the annals of peat for the publication by Charles Vignoles of his process for the manufacture of coke from peat, which was patented in the previous year and was carried out upon a considerable scale in Germany. His plan consisted, in its essential features, in the subjection of air-dried peat to the action of superheated steam, in closed iron vessels. This treatment was continued until the peat became fully carbonized, when the contents of the vessel were "converted into an almost perfect vegetable charcoal." It is somewhat difficult at the present day to accept the figures given for the cost of the process in a book published on the subject, but it was assumed by the inventor that 40 tons of merchantable coke could be produced from 100 tons of dried peat, at a cost of $2.00 a ton (long). The expenses of the manufacture are given in great detail. In Germany where at that time English coal coke was selling at $9.60 a ton (long) the manufacture of the fuel in question appeared to be a very attractive proposal and works were erected at Friesack, some 30 miles from Berlin, for the supply of the Berlin & Hamburg Railway, and also for sale in Berlin. A sanguine view was expressed by Mr. R. Mallet, of Dublin, concerning the possible utilization of Irish peat, and it was estimated that Ireland with her two million acres of peat bogs might produce 1,858,000,000 tons of coke, at $1.68 a ton (long). The result would be the recovery of products to the value of $3,160,000,000. These figures are quoted in order to show the flattering aspect of the anticipated returns.

Condensed Peat. Shortly after the publication of the Vignoles patent, many attempts were made to render peat better adapted for fuel purposes by various systems of consolidation. It had long been known that moist peat, when prepared by any process capable of breaking up the fibers, became much more dense, and yielded, when dried, a more compact and valuable fuel. The methods introduced by Gwynne in 1853, and by Exter, in 1856, both aimed at the consolidation of the raw material, in the former case by the use of a centrifugal machine, or rollers, and in the latter by means of powerful presses. About this period, also, much attention was directed to processes, such as that of Challeton, in which mechanical power was employed to cut and macerate the moist peat, and many inventors exercised their ingenuity in devising methods which were at the best little more than imitations of the Irish and the Dutch manual systems of preparing the so-called "hand peat." For this purpose Challeton, at his works in the vicinity of Paris, used toothed rollers by which the fibrous substances were crushed and disintegrated, with a view to preparing a denser product, and machinery of the same kind was employed later at Langenburg, in Prussia; none of these works, however, proved more than moderately successful. Mention may be made of somewhat similar schemes based upon the use of a pugmill, such as those of Weber and Schlickeysen, the latter introduced about the year 1860. In America, pugging processes of a complicated type were used with more or less advantage, but in nearly all of these cases the costs of the plant and treatment were too high, as compared with the value of the resulting fuel, and this has all along been the rock upon which inventors of peat processes have suffered shipwreck. Messrs. Ashcroft and Bettely introduced triturating and combining machines in conjunction with brick presses, by which means they produced peat blocks, said to be "equal to the best English cannel coal," but here again the product would not repay the costs of the manufacture.

Peat Charcoal. A vast number of inventions have been made for charring peat, either in special vessels or kilns, or, more rudely, in heaps, based on the principle of the **meiler** of the charcoal burner. In some cases artificial drying has been combined with the preparation of the peat charcoal; in others the peat used has simply been air-dried. It is a notable fact that peat which has been subjected, while in the moist condition, to mechanical treatment for the destruction of the fiber, dries much more readily and completely than if simply cut as ordinary turf. In countries where coal is dear and labor cheap and plentiful,

it has been found possible to prepare peat charcoal for use in metallurgical operations with a sufficient margin of profit to repay the outlay if used on the spot, and the charcoal thus made is often fairly dense and admirably adapted for the purpose.

Illuminating Gas From Peat. It was in connection with the carbonizing process that attention was originally directed to the possibility of employing peat for the production of illuminating gas. A ton of good peat will yield from 6,000 to 8,000 cubic feet of gas, equal in quality, if not superior, to that made from coal, and although peat has been used for this process on a commercial scale in Germany, the works are believed no longer to be in operation. By the employment of iron retorts of the D form, 24 inches wide, 12 inches high, and 9 feet in length, bedded horizontally, Professor Pettenkofer, of Munich, succeeded in obtaining 8,000 to 9,000 cubic feet of gas per ton from a fair sample of peat. The coke or charcoal thus obtained as a by-product was valued at a higher price than wood charcoal, though it was rather liable to crumble. One of the chief drawbacks to the gas-making process was the large percentage (25 to 30 per cent) of carbonic acid gas present, which entailed heavy costs in purification and much reduced the amounts of available lighting gas.

Sewage Treatment. The porous charcoal made from certain descriptions of peat was at one period in great demand for the purification of sewage water. So far back as 1850 Prince Albert had directed attention to the value of charcoal for sewage filtration, and in the early seventies of the last century a company was launched, under the name of the Peat Engineering and Sewage Filtration Company, which undertook the treatment of the whole of the sewage of Bradford, amounting to five million gallons daily, by passing it through 12 feet of peat charcoal. The leading spirit in this enterprise was Mr. F. Hahn Danchell, an engineer who had paid special attention to peat processes, and the inventor of the plant for the purpose. In connection with the Bradford scheme, works were established at Red Moss, near Horwich, for the preparation of the requisite charcoal on an extensive scale, and the process employed consisted in incorporating together an intimate mixture of rotted and macerated peat, as taken from the bog, with a certain quantity of moist clay. In spite of the magnificent promises made by the promoters of the scheme, and the hopes held out that it might eventually be possible to filter the sewage of London through beds of peat charcoal, the resources of the

company were speedily exhausted, and this use of peat was abandoned.

Chemical Processes. We now reach the era of the applications of chemical and electrical science to the peat industry, and here the future of peat utilization would seem to be a little more hopeful. A new feature at once comes into consideration, namely, the nitrogen content of the raw material, and as some kinds of peat contain nearly 2 per cent of nitrogen, it seems possible that its recovery in the form of sulphate of ammonia may become the main object of the treatment, and the other products will then be regarded as the residuals. Already, in the distillation of oil from shale, the combined nitrogen is of so much importance that its value, when obtained as sulphate of ammonia, is sufficient, in some cases, to pay for the whole treatment, and the time may be near at hand when the ammonia plant may be the object of the chief solicitude in the utilization of peat. In the process introduced by Martin Zeigler for the manufacture of coke from peat, in accordance with which works have been installed at Beuerberg in Bavaria, it is stated that 100 tons of air-dried peat yield 4.5 tons of tar, from which is obtained paraffin and oils, and produce also 46.6 tons of water, rich in ammonia, wood alcohol, acetic acid and other substances.

Another step in advance is foreshadowed in the use of peat in the gas producer. Professor Frank and Dr. Caro have succeeded in adapting the Mond producer to burn peat containing 50 to 55 per cent of moisture, that is to say, in a condition to which it can readily be brought on the peat bog, by simple draining and air-drying. The gas so made contains from 17 to 19 per cent, volumetrically, of carbonic acid, 9 to 11 per cent of hydrogen, 2.4 to 3.6 per cent of methane and 42.6 to 46.6 per cent of nitrogen with a trace of oxygen. The combustible constituents thus amount to 36 to 39 per cent and the gas has a calorific value of 157.5 B. t. u. per cubic foot. Gas of this description can be employed with good effect in the internal-combustion engine, and, in this way, power is obtainable to generate electricity for overhead transmission to distant points, and all costs of transportation are avoided. The concurrent production of ammonia provides a further source of revenue, since the raw peat yields under treatment from 63 pounds to 66 pounds of sulphate of ammonia per ton of theoretically dry fuel gasified.*

Woltereck Process. A plant for the direct production of

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* This is the yield where there is about 1 per cent. combined nitrogen in the peat. Where the percentage is higher, the yield is proportionately higher.—Editor.

sulphate of ammonia from peat on the Woltereck system was erected a few years ago at Carnlough, in Ireland, and according to the views of the inventor was destined to prove highly renumerative. A small experimental works in the vicinity of London had previously shown good returns, and the opinions expressed concerning the process by experts were extremely favorable; but chiefly, it is believed, for want of sufficient capital, the manufacture has now been discontinued. In Germany, however, the profits obtained on this system have been adequate for the prosecution of the work and considerable quantities of ammonia are now being made from peat.† In all these cases it is well to remember that the nitrogen content of peat varies between rather wide limits, and it is important that choice should be made of suitable raw material. It by no means follows that because one description of peat gives good results, similar returns may be expected to be obtained from peat from another locality, or even from a different part of the same bog. It is quite possible that with certain qualities of peat it may be feasible to distil the tarry matters to advantage and to secure a fair yield of heavy and light oils, but it is of the utmost importance in most of these chemical processes to utilize completely all the residuals. The production of power from peat on the bog itself is now commercially possible, and it, taken in conjunction with the recovery of the ammonia and the tar products, holds out better hopes for future success than those systems in which peat is prepared as a fuel to be used at a distance. In every such case the cost of carriage appears to consume nearly all the profits.

HOW WE DRAIN OUR BOG.

By Dr. J. McWilliam, London, Canada.

To get a natural outlet for our bog we had to dig a ditch a mile long and mostly through quicksand. As we had already drilled two wells on our farm to a depth of 160 feet we knew the strata that probably lay under the peat bog.

We set up a drilling apparatus in May, and drove a five-inch well, using steel casing. At 130 feet—31 feet into the rock—we struck water, which rose to within 17 feet of the surface and was not lowered by a steam pump. We drilled holes in the casing, from the water level in the well up. We protected

† This statement is apparently an error so far as Woltereck's process is concerned.—Editor.

the well from silt or sediment by a wall of stone and broken brick for 4 feet all round; we then tile-drained the bog, ending our drains at the broken brick and stone at the mouth of the well.

The drain so made works very satisfactorily. All of the water from heavy rains runs off in a few hours, and the water in the casing never rises an inch. Sometimes a large stream is pouring into the well from the tile-drains, but the well takes it all. The surface of the bog is changing and getting firmer.

The good points of this method of draining a bog are:

(1) The first cost is not great; (2) The outlet is on one's own property and is under his own control; (3) the well can be used as a source of water if desired; (4) the well never caves in or becomes blocked up; (5) the casing can easily be plugged with a piece of wood, like a cork in a bottle, and the water level in the bog can thus be raised to any point desired.

I now regret very much that I had not drilled this well and adopted this method of draining seven years ago. I would have saved much money and had a much better bog to work on today. The method described is, in my judgment, ideal for draining any bog that has not a good natural outlet, and in this part of the country no bog that I am acquainted with has a good outlet.

THE UTILIZATION OF PEAT TIDE LAND.

By G. Herbert Condict.

It is assumed that the peat lands under consideration in this paper are of large extent and are under water or practically so, and that it is not desirable or feasible to drain them. This assumption eliminates from the discussion such processes and machinery as apply particularly to dry or drainable bogs.

It is also assumed in the first type of plant outlined, that there is, within a reasonable distance of the bog to be worked, a stretch of land of suitable soil and sufficiently elevated above water level to be made into a drying ground.

In this plant, drying is to be performed by the sun and air method, the object being to secure air-dried peat at a commercial cost, by largely eliminating labor, on account of the freouent scarcity, inefficiency and high rate of wages incident to the employment of the same.

The drying ground should be laid out in parallel strips or sections, each about 80 feet in width and as long as the nature and extent of the ground will permit. Each section should be

surrounded on all four sides, by a dike, two or more feet in height, provided with ducts, draining into ditches outside of the dike.

If a suction dredge is used for excavating the peat, the material can be pumped direct to the drying grounds through permanent pipes laid between the sections and having a sufficient number of discharge openings to secure uniform distribution. A suction dredge will thoroughly mascerate the material, so that a pug mill will not be required.

Should a dipper or clam-shell dredge be used for excavating, some form of press or dewaterer should be installed at the dredge, so that the free water may be removed from the material, which will then be reduced in bulk by two thirds, with the resultant reduction in transportation cost. The peat can then be transported by lighter and conveyor to the distributor on the drying ground, hereafter described.

In this system the distributing, leveling, agitating and collecting devices would be supported on a traveling gantry crane, consisting of two or three steel girders spanning the section and supported at each end by a geared truck, running on rails, permanently and substantially installed, one on each of the long sides of the section.

This crane also supports a hopper of from 25 to 50 tons capacity.

If the material is to be pumped by suction dredge, no distributor will be required. In the event, however, that a dipper or clam-shell dredge is used, with a dewaterer, the dewatered material will be delivered to the crane hopper by conveyor, from the lighter.

As the crane moves along the section, with loaded hopper, the dewatered peat will be dropped by a distributor, followed by an adjustable levelling board, so that a finely divided, loose bed of material will be left, which will be in a most advantageous condition for exposure to the sun and air for drying. At intervals, the length of which will be dependent on the drying action, the crane will move along the section, while an adjustable spike or disc agitator will thoroughly break up and redistribute the material to any desired depth, thus exposing fresh particles to the drying action of the air.

When the surface of the peat has been sufficiently dried to a depth of from one-fourth to one-half an inch, a mechanical or suction collecting device, carried on the crane, is put into operation, and the material deposited in the hopper, which, when full, is run to the end of the runway to be dumped onto a conveyor, which transports it to a storage bin, if sufficiently

dry, or to artifical dryers, when it is necessary to still further reduce the moisture content.

Where one crane is sufficient to work more than one section, a simple form of transfer-table will be provided, which will move the crane from one section to another.

Electric motors, receiving current from a central generating plant, will provide power for all operations.

This in a general way is a description of the plant, which has been sufficiently worked out in detail to determine that it is feasible and economical in operation, when not less than 100 tons of product is to be produced in 24 hours.

The labor item should not be large owing to the fact that, at most, only 2 men will be required for the crane manipulation and the field work will consist only of opening and closing distributing and drainage ducts, and as the entire plant will be substantially and permanently located, a large gang of laborers for moving purposes will not be required.

The drying ground will be at least 10 acres in extent for 100 tons production, but this will vary with climatic conditions and the moisture content desired in the product.

The item of power is also not prohibitive in cost, as the crane will move slowly at all times and only one of the devices with which it is equipped will be operating at any one period.

When in such a bog as that described, a smaller production than 100 tons per day is desired, or the bog is too limited in extent for an expensive permanent plant, or for any reason it is not feasible to utilize a drying ground, or the climatic conditions are not suitable for sun-drying, a floating plant has heen designed, embodying features which it is believed will render economical operation reasonably certain.

A dipper or clam-shell dredge, equipped with a pug mill, or preferably a suction dredge, will deliver the material directly to a dewaterer, in which the moisture content will be reduced to 70 per cent, and this in turn will deliver to a hot-air dryer, which will reduce the moisture content to the desired degree for the product.

The practicability of this plant depends on two factors, which are: First, the securing of an economical and reliable dewaterer, and, second, the availability of cheap fuel.

For almost two years past the writer has been investigating various methods of dewatering and has carried on extensive experiments in different parts of the country with, it must be confessed, mostly discouraging results, but at the same time there has appeared, here and there, sufficient of the leaven

of the practicable to convince him that the desired object can be attained, and that, too, without resorting to freak or revolutionary methods. The development has not yet proceeded to the point where actual commercial operation can be shown, and having in view the many ghostly forms of disastrous failure which rise to haunt the dreams of the otherwise hopeful peater, the writer will refrain at this time from any further reference to what he believes will eventually prove a simple and economical dewatering method of producing peat having somewhat less than 70 per cent moisture content, regardless of the initial water content of the material.

In localities where fuel can be had at low cost, possibly utilizing a percentage of the product, the cost of reduction below 70 per cent moisture by artificial drying is not prohibitive, provided all costs of transportation during manufacture can be eliminated and labor reduced to the minimum, as is the case with the self-contained floating plant.

DISCUSSION ON MR. CONDICT'S PAPER.

Prof. Davis referring to the value of peat as a fertilizer in Florida, said: "With regard to the matter of soil, anybody who has been in Florida knows that there are many hundreds of square miles of what is apparently nothing but quartz sand. Where the water level is high, good crops can be grown, but in other parts the vegetation that grows on these sandy soils is in dry weather only a thin stubble. Add vegetable matter in the shape of peat, and you get a mixture which enables the sand to hold to a great extent the water which comes in the form of rain, as well as that which is brought up from below by capillary action. Consequently, the people there, and especially the orange growers are reported anxious to get this relatively cheap organic material. This is a thing, however, which needs to be administered scientifically, and under conditions which cannot be questioned, and I believe one of our functions as Peat Societies is to bring about this scientific study of the possibilities of the use of peat as a soil ameliorator. Just as soon as we can get to it, I think the Societies should have it in mind to find out just how much good the addition of peat does to quartz sand, and the conditions which would make this a commercial proposition."

Professor H. C. Thompson, of the U. S. Bureau of Plant Industry, Washington, D. C.: "I do not believe the use of peat for bettering sandy soils would be practicable except for crops of very high value. It is possible it would be on sandy orange

groves, but I think it is entirely out of the question for the general farm crops grown in the south. The amount of this material necessary to have any effect on the water-bearing functions of the soil would cost too much on a soil where crops like cotton and corn are grown.

Prof. Davis: How do you know?

Prof. Thompson: I don't know; it is my belief. I am under the impression that the amount of peat necessary to put on these soils to have any appreciable effect on the water-bearing capacity would be worth more than the cotton crop would amount to. The average farm does not get a return of more than $12 or $15 an acre, and I am sure it would take at least that much peat to do any good. Scattered over an acre of land, 5 tons of peat would be a mighty thin application.

Prof. Davis: You may be right. Still we don't know where peat can be used to the best advantage; we can only surmise.

Prof. Thompson: There is one other point I had not thought of. I have been in Florida quite a bit, and I remember that there are many truck farms where there are crops of from $500 to $1000 per acre, and on these it pays to put a high-priced fertilizer. I know some which have put on three tons of chemical fertilizer per acre. If farms of this kind are deficient in humus it might pay to give them a dressing of peat.

Mr. Condict: It is among the farms which have high-priced crops that the demand exists at present.

Mr. Emslie: I am inclined to agree that for ordinary crops it would not pay to apply peat. I think the best use of peat, and that where we get the fullest value, is where we use it as a bedding material. It absorbs liquids. I have had considerable experience with peat litter and have found it much more valuable than straw.

Prof. Davis: The ordinary peat which comes from southern swamps, if not dried carefully is apt to dry in hard lumps as hard as soft coal. It needs to be aerated a good deal. It is not like northern peats. It is really an organic mud, and has to be handled quite differently from anything we get in the northern peat deposits. The proof of all these things is not theory, but practice. You cannot sell farmers fertilizers that do not fertilize. If they try a fertilizer and get results, they will buy again, but you cannot persuade them to put their money into material they have tried once without results, no matter how much their soil may, according to theory, need the stuff you recommend. There is an ancient prejudice, coming from our

ancestors, that any dark soil is a good soil. Still you find some dark soils of which this is not true. Yet farmers will often buy a fertilizer that has a dark color, even if the color comes from charcoal. What we want to get at is the value of these things in dollars and cents—how much peat it is necessary to put on land in order to get twice the crops the land produces now.

LAND RECLAMATION IN HOLLAND.

At a recent meeting at Arnhem of the Nederlandsche Heidemaatschappy (Netherlands Heath Co.), a national organization for reclaiming marshy and other waste lands and of generally aiding agriculture, forest culture, etc., a speaker said that there was in this country more than 250,000 acres of the best soil still under water. This does not refer to the soil under the Zuyder Zee, which it was proposed to drain half a century ago—a project still discussed pro and con; nor to the soil under rivers and canals, but only to that under useless water. Yet drainage has been steadily prosecuted for centuries in this country, and the area being reclaimed at present amounts to between 20,000 and 25,000 acres a year.

The Heath Co. is doing an important and valuable work, not only toward reclaiming waste lands and assisting agriculture, but also by turning many reclaimed tracts into much-needed forests. That its work is appreciated is shown by the fact that a special building has just been erected and furnished for the company at Arnhem, costing about $50,000 and paid for out of public funds.

THE USE OF PEAT IN HOLLAND.

Probably in no other country have peat deposits been put to such a systematic and abundant use as in Holland, from early times. By a large outlay of capital combined with intelligence and skill, the native bogs and marshes have been drained by canals. These ditches were made of such a size that they not only served to drain the water from the peat deposits but at the same time could be utilized as ship canals. The peat, made thus accessible, is dug out, dried and pressed into brick-like form. The peat bricks are loaded on flat-bottom boats on the peat canals, which join the chief canals that exist all over Holland, and are thus transported to the places where they are used. As return freight these boats are loaded after discharging the peat, with street or other refuse, which cities are glad to dispose of and even deliver it free to the boats. This refuse is used as fertilizer on the soil from which the peat has

been removed. By this method a large part of Holland not only obtains cheap fuel, but, yearly, large marshy tracts are made accessible and turned into profitable agricultural soil which gives farmers an opportunity to own good and profitable property. Yearly new colonists settle in such places, thus continually increasing the agricultural acreage, and the colonies generally flourish. The canals are also handy to these settlers, as they form easy and cheap routes for shipping their farm products either to the cities or for export. Even German markets receive a considerable quantity of vegetable products from these peat colonies.—Electrotechnische Rundshau, 1913, Vol. 30, p. 220.

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EDITORIAL NOTES.

The Co-operative Work of the U. S. Department of Agriculture With This Society. It will be remembered that, in the early part of the present year, the Society, through its Executive Committee, entered into an agreement with the U. S. Deparment of Agriculture to carry on cooperative work on the agriculture of muck or peat soils. The agreement was substantially that the Society should furnish enough selected peat land of agricultural value on which to carry out carefully planned field experiments with a variety of crop plants known to be adapted to muck soils, and furnish the labor to care for the crops. In addition, enough of the peat from the land selected was to be furnished the department to permit a series of greenhouse experiments, already begun by the Bureau of Plant Industry, to be continued during the lifetime of the cooperation.

The Department of Agriculture agreed to furnish all the supervision and seed required for the detailed work and placed the matter in charge of the Bureau of Plant Industry, Division of Horticulture, which was already at work on some of the problems met by farmers in trying to raise the "truck" crops more commonly grown on muck soils.

The Society placed the matter of arranging details of the work in the hands of a committee of members who were successful and practical truck farmers and owners of considerable areas of peaty land. The editor of this journal was added to the committee as the arbiter who should select the type of peat deposit on which the experimental work should be done.

The actual field work was placed in charge of Professor H. C. Thompson by the Chief of the Bureau of Plant Industry.

In order to start this important work promptly, the President of the Society offered as much of his farm in New Jersey as would be needed for the first year's tests. This offer was at once accepted by the committee, as the land was typical of great areas of drained and drainable swamp land in the eastern part of the country. The experimental work was begun and carried on through the summer. The greenhouse work had also been carried successfully through a season and is being followed up by a second season's test of the same muck. The season proved exceptionally dry and the results of the field experiments, from the point of view of the investigator, not as satisfactory as they would have been if the rainfall had been normal. The records of the season's work were carefully kept, however, and will be reported on later.

Work for the coming season has already been planned, and, in addition to continuing the work in New Jersey, similar work will be started on one of the Todd farms, that at Mentha, Michigan, where the muck and the climate are considerabbly different from those in New Jersey.

One of the things aimed at in this work is to make it as broadly general as possible so that the greatest number may reap the benefit, and in order to do this, muck lands of different types, at least so far as the origin of the deposit, conditions of climate, stages of decomposition, drainage, etc., are concerned, will be selected for each series of tests.

The importance of this investigation to the Society and to the farmers of the parts of the country where muck lands are found can hardly be overestimated and it is to be hoped that the work as planned can be carried to a satisfactory completion. The officers of the Bureau of Plant Industry who have charge of the investigations are greatly interested in the work and are leaving nothing undone to give it lasting value. The paper read by Professor Thompson at Montreal at the joint meeting was the advance guard of what is hoped will be a most valuable series. This paper, when the results reported in it have been confirmed by another series of tests, will be published both by the Department and this Society.

Converting Peat Lands Into Meadows. Several experiments on peat culture appear in Vol. 44 of the "Landwirtschaftlichen Jahrbuch," issues 1 and 2. To make a meadow out of wet peat land it is necessary first to dewater the deposit, not by open ditches but by tile drains. It is then necessary to compress spongy peat by using heavy rollers; after seeding a meadow is obtained for growing grasses suitable for hay. If it is desired to neutralize the acidity of the peat with lime, care must be taken as it is dangerous to add too much.

Sodium Nitrate on Peat Soils That Are Too Heavily Limed. Saltpeter is partly reduced to ammonia in peaty soils. Ground that is over limed can form the saltpeter into nitrous acid products for a length of time, which not only leads to nitrogen losses, but also to direct damage to the growing crops. In addition to nitrates, nitro and nitroso compounds are formed which are also probably injurious to vegetation.

Peat in Japan. A report on the mineral industry of Japan submitted by the British Legation at Tokio gives the following figures on the production of peat: In 1911, 97,656 tons; in 1912, 102,830, showing an increase of 5,174 tons.

The Ekelund Process. It is authentically reported that Lieutenant Ekelund's peat plant at Back, Sweden, manufactured about 12,000 metric tons of peat in powder form during the season of 1912. It will be remembered that this plant and process were fully described* some time ago, and it is a matter of great interest to know that the inventor's expectations of commercial success are being realized. Attention is also called to the report on this subject of U. S. Consul Douglas Jenkins, of Goteborg, Sweden, on another page of this number.

Drainage of Peat Bogs in Minnesota. There are in Northeastern Minnesota some of the most extensive areas of peaty land in the country. These great swamps, or muskeags, as they are called, have much the aspect and many of the characteristics of the wide stretches of "high moor" to be found in Northwestern Europe. Until very recently these swamp lands have been considered of small value as the timber on them was generally much stunted and had little, if any, commercial value, while the agricultural value of the cleared land was even lower than that of the timber.

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* This Journal V:1:27, 1911.

Within the past two or three years the state and county authorities have started a very extensive system of drainage canals and ditches, which, taken together with the drainage work done by the railroads in the same region, is beginning to so affect the water level of some of the areas of muskeag that they can be cleared and cultivated. The peat is largely made up of the remains of Sphagnum and the shrubs of the heath family and other plants which grow with the Sphagnum, and is generally poorly decomposed. In several places, however, where this kind of land has been properly drained, good crops of oats, clover, grasses and potatoes may be raised. The State Agricultural Experiment Station has a demonstration and experimental farm on a drained swamp at Meadowlands, northwest of Duluth. The land departments of some of the railroads which cross the muskeag country are carrying on similar agricultural work. A careful study of the methods of culture worked out and the results obtained from the long-continued experimenting on the "high moors" of Sweden, Germany and other countries of Northern Europe, will, without doubt, enable those in charge of the work in Minnesota to get the very similar swamp lands of that state under profitable cultivation much sooner than if this great body of information were not available.

Peat in Brazil. It is seldom that definite word regarding peat deposits reaches us from any part of South America. We are accustomed to think that the warmer parts of the world do not have workable beds of peat. The following item culled from Oakenfull's interesting book, "Brazil in 1911," will therefore be a welcome contribution to our knowledge of the distribution and use of peat: "A company is (in 1911) now working at Bon Jardin, in the state of Minas Geraes, a deposit of lignite and peat, the latter of which contains 7.5 per cent of ash, 8 per cent of water and 62 per cent of carbon. Briquets of a very good quality are being produced."

It must be assumed that the partial analysis given, is that of the briquets in the finished form, and not of the raw peat, as the low moisture content shows that it was thoroughly dry when the analysis was made.

Swedish Peat in the United States. It is reported by Consul General Harris of Stockholm, from statements made to him by interested dealers in Sweden, that "there have been numerous inquiries recently from America about Swedish peat. It is claimed that this article is of good quality and that the

outlook is favorable for successful competition with peat from Germany."

Doubtless the statement refers to peat stable litter, which is produced and used in increasing quantities in Sweden. The chief reason why the German and Dutch producers hold the American market is that they get very low freight rates across the ocean. The lines from Sweden are not so strong as and have a longer route than those from Holland to the United States, hence cannot or do not give as low freight rates on their westward trips. The Swedish peat is reported to be of excellent quality.

PERSONALS.

Correspondence. Many times the editor has appealed to the members personally and through these columns for letters telling him what they were doing and whatever other news that might be of interest to their fellow members. Very little has come of these appeals and the personal element is therefore being eliminated not only from the Journal, but to a considerable extent from the Society as well. The editor still hopes that some of the members will send him information from time to time without his having to send out personal letters for it, but there is truth in the saying: "Hope deferred maketh the heart sick"!

John N. Hoff, President of this Society, has been in Washington several times since the annual meeting for conferences with the officials of the Bureau of Plant Industry of the U. S. Department of Agriculture, relative to the cooperative tests which have been undertaken to determine the best crops for peat and muck soils and the most satisfactory methods of fertilizing and cultivating them. The arrangements which have been made are mentioned in another place in this number of the Journal.

The Editor, in carrying on part of his official work, was away from Washington from the middle of June until early in October. During this time he spent about two months in New England, engaged in geological work in behalf of the U. S. Geological Survey. The balance of the field season was largely spent in Minnesota examining some of the peat deposits in the northeastern part of the state. During this long absence the editorial work and correspondence was, perforce, largely in a state of suspension. This and other pressing work accounts, in some degree, for the lateness of the appearance of this number of the Journal.

Our Secretary-Treasurer, on whom we have come to rely as on no one else in the Society, returned from the Montreal meeting and soon succumbed to a severe attack of appendicitis. A surgical operation promptly removed the offending appendix, but for some weeks the patient was very ill, and only good care and a fine and unimpaired constitution made recovery possible. Mr. Bordollo has entirely recovered at this writing and is attending to his usual duties with his old time vigor.

Dr. Herbert Philipp, our exchange editor, made the trip from New York to Montreal in a yacht as part of his annual vacation and appeared at the opening meeting of the Peat Societies as properly sunburned as if he had just come in from the peat fields. Dr. Philipp is a charter member of the American Peat Society and has always been one of the most active and interested members and the Society is immensely indebted to him for the great amount of work which he does in preparing the abstracts and reviews which he so generously gives us in each number.

NEW PEAT COMPANIES.

Notices have been received from various sources of the formation of several new companies for utilizing peat during the past few months. Some of these are now members of the American Peat Society, and all should be. Further information is desired regarding all of these new organizations.

The Peat Humus Co. This company has a plant at Lakeville, Ind., for the manufacture of peat fertilizer, filler and similar products. It is the successor of the Peat Products Co., which was organized some years ago for the manufacture of briquets from peat, by a new method and specially designed machinery, but which never reached a commercially productive stage. The officers of the new company are J. W. Wilson, president; T. W. Davis, secretary and treasurer, and R. B. Agler, superintendent.

The Peat Liquid Products Co., Inc. The headquarters of this company are in New York City. It is incorporated under the laws of Delaware, with an authorized capital of $6,000,000, for the purpose of "manufacturing from peat or other vegetable or mineral substances a volatile liquid that can be used as a substitute for gasoline and all similar products." The incorporators were H. O. Coughlin and Joseph F. Curtin, both of New York. Further information regarding this company and its process is looked for with interest.

The United States Fuel Co. This is a Boston company, recently organized, which as yet has made no announcement of its officers or its plans. The name indicates that it is the intention of the promoters to produce fuel and our informant states that peat will be the material from which this is to be made.

The National Peat Refining Co. Although this company is incorporated under the laws of the state of Delaware, its headquarters are given in the announcement as 433 Williamson Building, Cleveland, Ohio. The incorporators are reported as A. R. Thompson, R. B. Hartwig, Ed. H. Jacobs and Robert O. Bartholomew, all of Cleveland. The authorized capital is $500,000. The plans so far announced include the erection of a plant near Canton, Ohio, for the manufacture of gasoline, wood alcohol, charcoal, potash, tar and turpentine from peat.

AGRICULTURAL ABSTRACTS.

The Right Drain for the Right Place. An excess of water during certain periods of the year is damaging over 7,000,000 acres of Wisconsin lands, of which one-third consists of muck and peat marshes, and two-thirds mostly of wet clays. Excessive water in these soils is detrimental because: (1) Lands are too soft to cultivate; (2) cultivation is delayed in the spring; (3) wet soils are cold; (4) air is kept out of the ground and decomposition of vegetable matter is checked; and (5) standing water prevents healthy root development. Drainage is the removal of water by the force of gravity. The force of capillarity in a soil forms a limit up to which drainage is necessary and beyond which it is impossible.

The cause of the excess of water is either entrance of too much water or the removal of too little. Areas can be drained either by carrying the damaging water around them, or by hastening its passage through them.

The kinds of drains in common use are (1) the surface run, for surface water; (2) drain tile, for under-drainage; (3) the outlet ditch to deepen and straighten the beds of sluggish creeks or small rivers; (4) the make-shift outlet, which is about the only place where the capstan ditch should be tolerated; (5) the vertical drain; and (6) the pump and dike.

Typical drainage projects, both farm-drainage projects and organization projects are described, showing the nature of the area, the details of the drainage systems, and the specific results of drainage. The formation of a drainage district secures the cooperation of several land owners, even though some may be unwilling. E. R. Jones, Bul. 229, Wisc. Agri. Expt. Sta., 1913.

Horses on Peat Deposits. Anent our abstract on rolling peat (this Journal 1913, Vol. 6, p. 24), several remarks have been made to the effect that horses would sink on the peat deposit. We therefore give here a method of making "footwear" for the horses, when employed on peat lands. Washed-out, discarded fertilizer bags are folded once, the horse's hoof is placed in the center of the same, the corners of the sack are then turned up around the hoof and secured with string. Those who have large peat deposits to roll annually will find it advisable to use clamps, made of flat iron bands, in preference to the string, as they fit better and hold the bag tighter. If the bags are put on wet no chafing of the skin takes place. Farm help is liable to consider the usefulness of this "footwear" lightly, but it is very important, and a half hour spent in putting it on is well repaid by the ease with which the horse works. By this means horses can work on peat deposits in the spring where a man would sink in up to his ankles.

The Chemistry of Soil Nitrogen. Nitrogen in soils is combined as ammonia, nitrites, nitrates and organic compounds. The latter usually contain the bulk of the soil nitrogen. The available nitrogen is in the form of ammonia and nitrates. Soil nitrogen is the cheapest and best but the compounds have not been fully and advantageously utilized because of our lack of knowledge concerning their chemical nature. Latest researches of soil organic nitrogen represent the very means for the solution of the problem as to how to utilize the soil nitrogen.

As to the amount of ammonia present, as such, in Michigan peat soils, it was shown to be quite small, namely, from about one-tenth to one and one-half per cent of the total nitrogen contained in the peat. This was also shown to be true of Iowa soils in which the total quantity of ammoniacal and nitric nitrogen ranged from one to somewhat more than 2 per cent, calculated to the total soil nitrogen. The extension of former investigations has been demonstrated that the above facts hold also good for Iowa soils, which were fertilized with various organic materials and grew a considerable variety of crops. In all of the above soils from 98 to 99 per cent of the total soil nitrogen consisted of organic nitrogenous compounds.

The author discusses minutely the work already accomplished regarding the organic nitrogen compounds and the possible changes that have been gone through. The chemistry of the organic nitrogenous compounds in soils can at present broadly be stated as follows: Under the action of proteolytic enzymes, micro-organisms or chemical means, the proteins are decomposed, probably through the stages of albumoses, peptones

and polypeptides—chiefly to diamino acids, mono-amino acids and acid amides. The author closes with a bibliography on the subject.—S. L. Jodidi, Journ. of the Franklin Institute, 1913, Vol. 175, p. 483.

The Behavior of Acid Amides in the Soil. As plant food it is the available nitrogen, viz. ammonia and nitrates, which is of special importance. The nitrites and nitrates present in soils are chiefly the results of the nitrification of ammonia. Again the production of ammonia in soils is closely associated with the chemical nature of the organic nitrogenous compounds occurring in soils. Accordingly the author has studied the chemical changes of amino acids in the soil to explain the process of ammonification of the nitrogenous compounds of the soil.

Acetamide and propionamide readily undergo in the soil the process of ammonification. As in the case of amino acids, the rate of transformation of the acid amide nitrogen into ammonia is greatly influenced by their chemical structure so that acid amides of equal structure yield about the same proportion of ammonia. The maximum percentages of ammoniacal nitrogen obtained from acetamide and propionamide were 83.43 and 75.14 respectively.—S. L. Jodidi, Journ. of the Franklin Inst., 1913, Vol. 175, p. 245.

Celery Culture in Michigan. The celery industry of Michigan has advanced so rapidly during the last few years that this state stands pre-eminent as a celery-growing region. The abundance of rich muck lands and the comparatively cool, moist summers of southern Michigan combine to produce ideal conditions for the growing of this plant. The land upon which celery is grown must be thoroughly drained. The celery of Michigan is grown entirely on the heavy reclaimed muck lands that have been previously well drained. These soils are generally very deep, often extending from twenty to thirty feet before reaching the sub-soil which is generally of a hard stiff clay. The author describes the preparation and the fertilizing of the soil, also seeding and the mode of transplanting. Cultivating, blanching, storing, etc., are treated in detail.— C. P. Halligan, Special Bul. No. 60, Mich. Agri. Expt. Sta., 1913.

Liming Acid Soils for Growing Alfalfa is very profitable. Soil acidity is unfavorable to the growth of alfalfa and clover which are needed to retain the nitrogen for plant growth. These common plants growing in soils supplied with lime are able to use the nitrogen of the air for their growth through the work of certain kinds of bacteria which inhabit nodules on their roots. Liming and inoculation are usually necessary for growing alfalfa

successfully in acid soils. Liming should always precede inoculation.—Soil Acidity and Liming, A. R. Whitson and W. W. Weir, Bul. No. 230, Wisc. Agri. Expt. Sta., 1913.

Potato Yields on Peat Land in 1912. Peat-grown potatoes have the reputation of being especially rich in nitrogen, but the investigation of samples from peat neighborhoods have not substantiated this supposition. Also one of the transmitters informs us that he has grown potatoes for 25 years on peat soil and sandy soil without noticing any superiority of the potatoes grown on peat soil.—J. L. Hoffman and Preckel, Zeit. f. Spiritus Ind., 1913, Vol. 36, p. 123.

Cost of Growing Onions on Muck. According to W. W. Ware, a successful vegatable grower of New York state, who, with W. L. Bonney, is cultivating a large acreage of muck to celery, lettuce and onions, the cost of growing a crop of onions on muck land does not vary a great deal from that of celery. He estimates the cost per acre about as follows, taking no account of overhead charges, such as interest on capital invested. taxes and depreciation:

Plowing and fitting soil	$ 6 50
Fertilizer	38 00
Sowing same	1 00
Seed, 6 pounds at $1.50 lb.	9 00
Sowing same	2 00
Hoeing, eight times	16 00
Hand weeding	40 00
Sorting and drawing to crib and car	30 00
Total	$142 50

—From Market Growers' Jour. Vol. 13, p. 8.

Peat Soil Mixed in Lighter Soils. The author shows that by mixing peat, even without fertilizing, with lighter mineral soils, the yields are greatly increased. No doubt the peat nitrogen has fertilizing value, but the influence of bacterial life which is increased by the peat as well as the water holding power of the organic matter benefits the soil.—Gerlach. Vers.-Stat., 1913, p. 681.

Treatment of Peat for Manurial Purposes. Peat, or a prepared form of peat, is treated with water containing soil, micro-organisms capable of producing ammonia, with or without nitrogen-fixing organisms. After some days, the material is dried or extracted with water. so as to furnish a dry or liquid manure, or it may be used for the manufacture of humic acid by

adding acid to the aqueous extract. Suitable nitrogenous matter, such as the waste liquor from the boiling of bones, and sugar or starch (about 0.1 per cent of the dry peat), dissolved or suspended in a little water, may be added to the peat. Before the treated material is dried, it may be sterilized and further treated with nitrogen-fixing organisms.—W. B. Bottomley, Br. Pat. 17,-487 (1912).

TECHNICAL ABSTRACTS.

Franke Process. In the Franke process for the utilization of peat, which is being worked experimentally in a small plant at Acton-green (England), the raw material is first passed through a disintegrator and is then pressed to reduce its water content. The press employed is of special construction, designed to permit the free escape of the water, and consists of a cylindrical container within which is arranged a series of concentric rings or partitions, placed vertically and parallel to the outer casing. The peat is packed into the spaces between these partitions, and hydraulic pressure is applied to it from below. The partitions have both their sides formed of wire gauze and are hollow, and thus the water squeezed out from the peat, readily drains away at a large number of points. It is stated that by this treatment the water in peat containing initially 85 per cent moisture can be reduced to 30 or 35 per cent, and that the resulting product is then in a condition in which it can be submitted to dry distillation with the object of producing coke, gas, and tar, the last yielding, by appropriate manipulation, motor-car spirit, heavy oil suitable for steam-raising purposes and various other products. If a still larger reduction in the amount of contained moisture is required, as is the case when the material has to be used for making briquets, the peat before being pressed is heated for five minutes in a special apparatus to a temperature of about 90 degrees Fahr. The object of this preheating is to break down the hydrocellulose and thus facilitate the elimination of the water in the subsequent pressing. Finally the peat cake is pulverized, when it is ready for the manufacture of briquets.—The Times (London) Engineering Suppl. Aug. 1, 1913.

Gasification of Peat for the Production of Ammonia in gas generators by the addition of limited quantities of air and an excess of steam, derived by the addition of the air and steam mixture in superheated form, or by increasing the heat of the combustion zone of the generator so that the temperature of the dehydrating zone is at least 250 degrees C. and consequently

the decomposition and hydrolysing (ammonia formation) of the material takes place with the dehydration.

An especial advantage of this process consists in being able to use half-dried peat (40 to 60 per cent water). By this means not only is 80 to 90 per cent of the nitrogen regained as ammonia but combustible gases are obtained which give about 1000 H. P. hours per metric ton (2204 lbs.) of peat.—N. Caro, D. R. P. 255, 291, 1909.

Dewatering Peat by Electricity. This process is based upon investigations carried out with a view to ascertain the most favorable conditions for the treatment of peat, to render its natural water expressible without any material decomposition of the peat. An electric current is passed through peat heated to a temperature of at least 100 degrees C., under a pressure sufficient to prevent the formation of steam. The electric current may be continuous or alternating, but a continuous current is preferred, as with it, in general, a lower temperature suffices than is required with an alternating current to produce as good results. The voltage of about 200 is found to be, on the whole, the most economical. As stated above, the temperature used is at least 100 degrees C., (212 degrees F.) and the range is 100 degrees to 120 degrees C. (212 degrees to 248 degrees F.) with a pressure of about 10 atmospheres (150 lbs. per sq. in.); much higher temperatures, with correspondingly increased pressure, may be used.—J. E. Jameson and O. H. Valpy and E. A. Buckle. Br. Pat. 10,370 (1912).

Peat Briquetting. Raw peat is disintegrated and heated in a steam-jacketed pan, and during the drying process, from 5 to 7½ per cent. of solidified tar, in a heated or melted condition, is mixed in to serve as a binder when the mixture is subsequently briquetted.—J. W. Butler. Br. Pat. 11,680 (1912).

Drying Peat. The peat is periodically subjected to mechanical pressure in a chamber with perforated walls surrounded by a vacuum chamber. Each time the pressure upon the peat is relieved, the pressure in the vacuum chamber is allowed to rise to atmospheric, so that the peat cells are alternately compressed and allowed to expand again and the moisture thereby eliminated more readily.—P. Roth. Fr. Pat. 451,864 (1912).

Gas From Peat. This is a process for producing gas from peat in an economical manner and consists in heating the substance in a rotary retort, then withdrawing the gas generated from the retort, condensing out the heavier distillates, the distillates being returned to the outlet pipe of the retort by gravity; then condensing out the higher distillates, dropping

them into a tank containing air above atmospheric pressure, then opening an outlet pipe so that the lighter distillates are blown at intervals into the retort accompanied by the air, and finally passing the gas into the gasholder.—J. D. Oligny. Br. Pat. 12,562 (1912).

Alcohol From Peat. Peat is heated for three hours under 5 to 6 atmospheres pressure with a 5 per cent solution of calcium bisulphite. The solution is drawn off from the residue of cellulose, mixed with a 10 per cent solution of sulphuric or hydrochloric acid, separated from the precipitated lignin, and returned to the cellulose in the autoclave. The mixture is then treated with a 0.25 per cent solution of hydrofluoric acid and heated at 140 degrees C. (284 degrees F.) until saccharified. The mineral acids are subsequently removed by a current of air under 2 to 3 atmospheres pressure, and absorbed in milk of lime or an aqueous suspension of chalk. The glucose, after neutralization with soda if necessary, is fermented and the alcohol separated by distillation.—L. Spassky. Fr. Pat. 451,268 (Feb. 9, 1912).

LIST OF EXCHANGES.

The following periodicals are received regularly in exchange by this Journal, Dr. Herbert Philipp, Perth Amboy, N. J., Exchange Editor:

Foreign.

1. Oesterreichische Moorzeitschrift, Staab, near Pilsen, Austria.
2. Technical Index, 51 Rue de l'Aurore, Brussels, Belgium.
3. British Columbia Mining & Engineering Record, Victoria, B. C.
4. Canadian Engineer, Toronto, Ontario, Canada.
5. Canadian Mining Institute, Montreal, Quebec, Canada.
6. Nova Scotia Institute of Science, Halifax, N. S., Canada.
7. Pulp & Paper Magazine of Canada, Reed Building, Montreal, Canada.
8. Hedeselskabets Tidsskrift, Viborg, Denmark.
9. Colliery Guardian, 30 Furnival St., Hollborn, London, E. C., England.
10. Elektrotechnische Rundschau, Potsdam, Germany.
11. Indian Engineering, P. O. Box 226, Calcutta, India.

12. Ingenieur, Gravenhage, Netherlands.
13. Meddelserfra det Norska Myrselskap, Kristiana, Norway.
14. Svenska Mosskulturfoereningens Tidskrit, Jonkoping, Sweden.

DOMESTIC.

15. American Fertilizer, Philadelphia, Pa.
16. Bulletin Am. Inst. of Mining Engineers, 29 West 39th St., New York City.
17. Cassiers Magazine, 12 West 31st St., New York City.
18. Chemical Engineer, 608 S. Dearborn St., Chicago, Ill.
19. Clay-Worker, 227 E. Ohio St., Indianapolis, Ind.
20. Cornell Civil Engineer, Ithaca, New York.
21. Daily Consular and Trade Reports, Washington, D. C.
22. Engineering & Mining Journal, 505 Pearl St., New York City.
23. Iowa Engineer, Ames, Iowa.
24. Journal of Franklin Institute, Philadelphia, Pa.
25. Journal of Western Society of Engineers, 1735 Monadnock Block, Chicago, Illinois.
26. Long Island Agronomist, Medford, Long Island.
27. Manufacturer's Record, Baltimore, Md.
28. Market Growers' Journal, Louisville, Ky.
29. Metallurgical and Chem. Engineering, 239 W. 39th St., New York City.
30. The Colliery Engineer, Scranton, Pa.
31. Mining and Engineering World, Chicago, Illinois.
32. National Engineer, 303 Dearborn St., Chicago, Illinois.
33. Practical Engineer, Brooklyn, New York.
34. Steam, 90 West Street, New York City.
35. Stevens Institute Indicator, Hoboken, N. J.
36. Vegetable Grower, 1208 Boyce Bldg., Chicago, Ill.
37. Western Engineering, 420 Market St., San Francisco, Calif.
38. Wood Craft, Caxton Building, Cleveland, Ohio.

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Devoted to the Development of American Peat Resources

CONTENTS

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American Peat Society

If you are interested in any degree whatever in Agriculture, Power and Fuel, Chemistry or any other uses of Peat, you should let us help you and you help us by becoming a member of the American Peat Society.

OBJECTS AND FOUNDATION.

Founded at the Jamestown Exposition on October 23d, 1907. Its object is to further the interest in the uses and application of peat for industrial and economic purposes.

PUBLICATIONS.

The Society holds one general meeting per year, and publishes a Journal quarterly, which is sent free to all members in good standing. The journal includes the proceedings of the meetings, original papers on practical experience, etc., also abstracts on all contemporary literature and patents, thus all the latest agricultural uses, fertilizer purposes, drainage, fuel, uses, technical uses, etc.

SOME ECONOMICAL POINTS OF INTEREST.

Prof. Chas. A. Davis, U. S. Bureau of Mines, estimates that there are about 12,000 sq. miles of workable peat beds in the United States, outside of the large number of beds very advantageously adapted for agricultural purposes, etc. He gives as a conservative average estimate a yield of 200 tons dried peat per acre foot.

Canada has at least 37,000 sq. miles of known peat deposits.

About ten million tons of peat fuel are used in Europe each year.

GENERAL INFORMATION AND ENQUIRIES.

All members have the privilege of making enquiries regarding general information about peat and its uses, by addressing the Secretary of the Society.

It must be understood that only general information and of a general character can be given. Members can obtain the names of experts in any special line, from the Secretary of the Society.